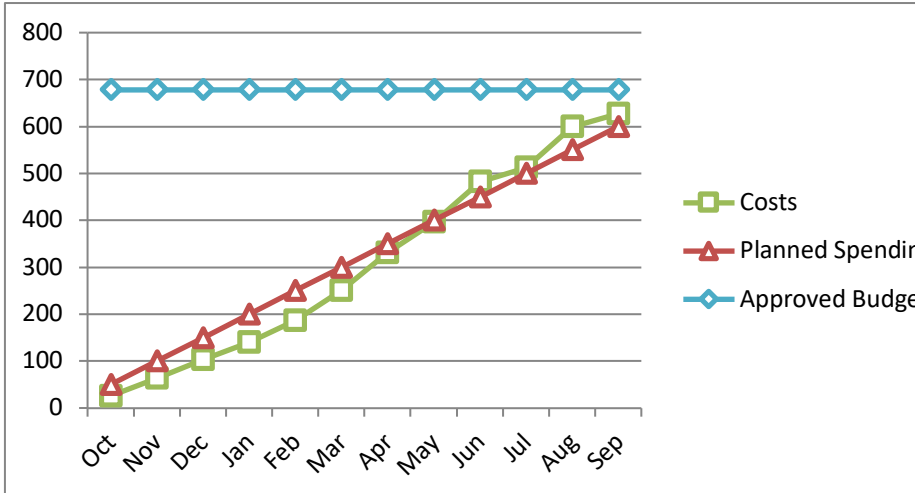# NUCLEAR CRITICALITY SAFTEY PROGRAM (NCSP)

FY2018 Q4   QUARTERLY REPORTS

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: AM1/AM2/AM4 (MCNP/NJOY/USL Comparison Study) M&O Contractor Name: LANL Point of Contact Name: Bob Margevicius / Bob Little Point of Contact Phone: 505-665-8965 / 505-665-3487	Reference: B&R DP0902090 Date of Report: October 24, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**

<table>
<tr>
<td>

1. Carryover into FY-2018 = $0.
2. Approved FY-2018 Budget = $1,567,000 (Includes carryover from FY-2017).
3. Actual Spending through the end of this quarter in FY-2018 = $1,456,444.
4. Projected carryover into FY 2019 = $0.

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MCNP

- **Education**
  - MCNP Criticality class at LANL, 12 students.
  - Thesis advisor for 2 UNM graduate students working in area of criticality calculations
  - 3 graduate student summer interns working on NCSP tasks (region dependent sensitivities, subcritical multiplication, benchmarks)
  - Started UNM Monte Carlo class for undergraduate & graduate students, 21 students
  - Lectures on Monte Carlo at X Computational Physics Summer workshop

- **R&D Work, continued to investigate & develop:**
  - region-dependent sensitivity-uncertainty data for NCS validation
  - fission matrix methods to diagnose & accelerate MC source convergence
  - diagnostic tests for undersampling & clustering
  - machine learning studies to understand the bias in criticality calculations and alternative ways to cluster similar benchmarks together
  - impact of correlated fission multiplicity models in criticality calculations
  - studies into the validation for chlorine.
  - impact of excluding benchmark outliers on the Whisper selection of similar benchmarks & on the Whisper baseline-USLs
  - new & improved methods for static-alpha eigenvalue calculations

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</table>

- **Support & Maintenance**
  - **Milestone completed:** Implement Fission Matrix automated convergence checking in MCNP6, issue report (AM1)
  - Code modernization effort - Efforts are in progress to improve SQA, implement some MCNP-2020 features, & upgrade portions of MCNP6. Includes more formal planning, design proposals, improved code review, SQA tools, and more. (Most of funding is non-NCSP.)

- **LANL-ORNL-IRSN Comparison of Sensitivity-Uncertainty-based USL Methods**
  - **Milestone completed:** Issue report on the Sensitivity-Uncertainty Comparison Study (AM4)

- **Reports & Publications (available in MCNP Reference Collection on web)**
  - F.B. Brown, C.J. Josey, "**Diagnostics for Undersampling and Clustering in Monte Carlo Criticality Calculations**", LA-UR-18-27656
  - F.B. Brown, W.R. Martin, "**Statistical Tests for Convergence in Monte Carlo Criticality Calculations**", LA-UR-18-28764
  - F.B. Brown, M.E. Rising, J.L. Alwin, C.J. Josey, "**State-of-the-art Advances in Monte Carlo Criticality Methods**", Contribution to DOE-NCSP newsletter, 2018-08-21.
  - B. Merryman, F.B. Brown, "**Investigation of Region-wise Sensitivities for Nuclear Criticality Safety Validation**", LA-UR-18-29058 - report on summer 2018 work with XCP-3
  - P.A. Grechanuk, M.E. Rising, T. Palmer, "**Using Machine Learning Methods to Predict Bias in Nuclear Criticality Safety**", Journal of Computational and Theoretical Transport, LA-UR-18-24800
  - M.E. Rising, P. Grechanuk, F.B. Brown, "**Methods to Predict Bias in Criticality Safety Applications using MCNP6 and Whisper**", OECD/NEA Working Party on Nuclear Criticality Safety, presentation for Subgroup 2, LA-UR-18-26230.
  - J.A. Alwin, F.B. Brown, "**Case Studies of Baseline Upper Subcritical Limits using Whisper-1.1: HEU-MET-FAST-013-001, HEU-SOL-THERM-001-008, PU-MET-FAST-022-001, and PU-SOL-THERM-001-001**", LA-UR-18-28704.

	- F.B. Brown, M.E. Rising, J.L. Alwin, "**Verification of MCNP6.2 for Nuclear Criticality Safety Applications**", submitted to ANS 2018 Winter meeting, LA-UR-18-25536 (2018) - F.B. Brown, M.E. Rising, J.L. Alwin, "**Verification of the MCNP6.2 Release for Nuclear Criticality Safety Applications**", LA-UR-18-25535 (2018) - F.B. Brown, M.E. Rising, "**Trip Report – OECD-NEA-WPNCS Expert Group Meetings Paris, France, 2-6 July 2018**", XCP-3 memo - C.J. Josey, F.B. Brown, "**Bias in Monte Carlo Alpha-Eigenvalue Calculations**", submitted to ANS 2018 Winter meeting, LA-UR-18-24670 (2018) - C.J. Josey, F.B. Brown, "**Fitting Nuclear Data with Chebyshev Polynomials**", submitted to ANS 2018 Winter meeting, LA-UR-18-24669 (2018) - T.P. Burke, F.B. Brown, "**Development of a Library for Computing Monte Carlo Tallies on Heterogeneous Systems**", submitted to ANS 2018 Winter meeting, LA-UR-18-24970 - F.B. Brown, "**Advances & Challenges of Monte Carlo Simulation**", lectures at MeV Summer School, Argonne National Laboratory, LA-UR-18-26714 - M.E. Rising, J.S. Bull, C.J. Solomon, F.B. Brown, et al., "**MCNP Version 6.2: New Features and Tools for RPSD Applications**", ANS RPSD 2018 topical meeting, Santa Fe, LA-UR-18-22358 - J.A. Arthur, R.M. Bahran, J.D. Hutchinson, A. Sood, M.E. Rising, et al., "**Validating the performance of correlated fission multiplicity implementation in radiation transport codes with subcritical neutron multiplication benchmark experiments**", Annals of Nuclear Energy, Vol.120, p.348-366, LA-UR-17-31332. - J.A. Arthur, M.E. Rising, J.D. Hutchinson, A.T. McSpaden, R.M. Bahran, "**Validation of MCNP6 Using Subcritical Benchmark Experiments**", Advances in Nuclear Nonproliferation Technology and Policy Conference 2018, Wilmington NC, LA-UR-18-24470. - M.E. Rising, "**MCNP(R) Version 6.2 Correlated Fission Capabilities**", 20th Topical Meeting of the Radiation Protection & Shielding Division, Santa Fe, NM, LA-UR-18-28545.
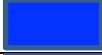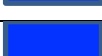
NJOY

- We continue to respond to user questions and requests for NJOY, providing updates as required.
- Two presentations were made at the RPSD 2018 meeting in Santa Fe:
  - "NJOY Status in 2018" where we formally deprecated NJOY2016 in favor of NJOY21.
  - "Benchmark Testing of ENDF/B-VIII.0 with MCNP."
- Also at the RPSD 2018 meeting, we presented an NJOY workshop with about a dozen participants.

NCSP Newsletter

We submitted two articles for the Summer 2018 NCSP Newsletter:
- State-of-the-art Advances in Monte Carlo Criticality Methods
- Release of ENDF/B-VIII.0-Based ACE Application Files for MCNP®

NCSP Quarterly Progress Report (FY-2018 Q4)
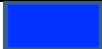
LANL AM Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
🟦	🟩	🟨	🟥

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Support MCNP6 users (AM1)	🟦	
	Support NJOY users (AM2)	🟦	
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2)	🟦	
	Provide reports on summer intern work accomplished (AM1)	🟦	
	Develop a plan to distribute ACE files independent of MCNP releases (AM1)	🟦	
Q2	Support MCNP6 users (AM1)	🟦	
	Support NJOY users (AM2)	🟦	
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2)	🟦	
	Issue an MCNP V&V report (AM1)	🟦	
Q3	Support MCNP6 users (AM1)	🟦	
	Support NJOY users (AM2)	🟦	
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2)	🟦	
	Provide training course on theory and practice of Monte Carlo criticality calculations with MCNP6 (AM1)	🟦	
	Release MCNP ACE data libraries corresponding to ENDF/B-VIII.0 (AM1)	🟦	
Q4	Support MCNP6 users (AM1)	🟦	

	Support NJOY users (AM2)	🟦	
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2)	🟦	
	Develop Doppler broadening capabilities in NJOY21 (AM2)	🟥	**Final implementation of Doppler broadening capabilities delayed until Q2 FY19 due to competing priorities.**
	Issue report on the Sensitivity-Uncertainty Comparison Study (AM4)	🟦	
	Develop a report for the NCSP manager on MCNP maintenance and modernization progress, the implementation of a parallel PTRAC capability, and the implementation of a Fission Matrix automated convergence checking capability (AM1).	🟥	**Partially complete. Report on fission matrix implementation finished. Report on parallel PTRAC to be completed in Q1 of FY19.**
	Issue a report on development and maintenance of the NJOY nuclear data processing code system (AM2).	🟥	**NJOY report to be completed during Q1 of FY19.**

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtasks: Analytical Methods, LLNL Analytical Methods (AM2), Sliderule (AM3), Analytic Benchmarks (AM6) M&O Contractor Name: Lawrence Livermore National Laboratory Point of Contact Name: David Heinrichs Point of Contact Phone: (925) 424-5679	Reference: B&R DP0909010 Date of Report: October 20, 2018

BUDGET	MAJOR ACCOMPLISHMENTS
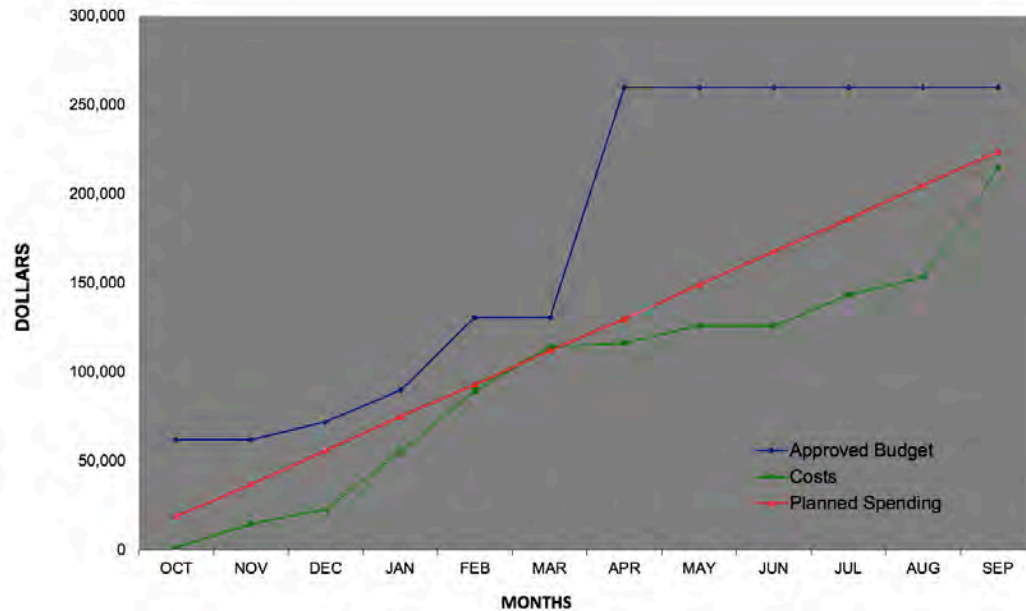
BUDGET

1. Carryover into FY-2018 = $17,016
2. Approved FY-2018 Budget = $260,016 (Includes carryover from FY-2017)
3. Actual Spending through the end of this quarter (in FY-2018) = $214,813
4. Projected carryover into FY-2019 = $45,203 (17%)

MAJOR ACCOMPLISHMENTS

LLNL Analytical Methods (AM1)

- Successfully processed JENDL-4.0 thermal scattering law data to yield the COG library T.JENDL4.

- Discrepancies previously noted in the NJOY-processed thermal scattering law data for SiO_2 are under discussion between NNL, LANL, and LLNL. Discrepancies are due to a number of known (NMIX error and ZAID limitations in ACER) and unknown causes (insufficiently optimized (alpha, beta) grid, integration algorithms, and a mystery with inelastic scattering).

- Implemented a new β_{eff} calculation in COG based on the ratio of fissions by delayed neutrons and by all neutrons. This estimate is 'exact' per Van der Marck.

- Provided high-precision COG benchmark results using ENDF/B-VII.1 to Isabelle Duhamel (IRSN) for a total of 1,487 ICSBEP benchmark cases for inclusion in the *Benchmark Inter-comparison Study* as follows:

```
PU:   512      U233: 191      MIX:   21
HEU:  486      IEU:  185      LEU:   92
```

- Provided high precision MCNP6.1 results for 1,067 ICSBEP HEU and PU benchmark cases using ENDF/B-VII.1 (.80c, .20c) cross sections to Isabelle Duhamel (IRSN) and Forrest Brown (LANL)

- Provided CRIT-2018-006, *Multi-Physics and PDV Progress Report*, to NCSP Manager on September 28, 2018.

Criticality Sliderule (AM3)

- *Update of the Nuclear Criticality Slide Rule Calculations – Studies with Common Shielding Materials* was presented and well received at the 20th Topical Meeting of the Radiation Protection and Shielding Division on August 27, 2018 in Santa Fe, NM.
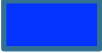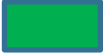
Analytical Benchmarks (AM6)
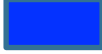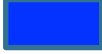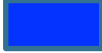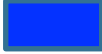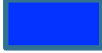
- Defer to next summer (FY-2019) due to delays related to Continuing Resolution and personnel changes to LLNL Supply Chain Management, which contributes $45,000 to the projected carry-over to next year.

NCSP Quarterly Progress Report (FY-2018 Q4)

LLNL AM Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
▮	▮	▮	▮

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, and AM6).	▮	
	Provide an annual report on the LLNL multiphysics capability development. (AM2).	▮	**Due Q4**
Q2	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, and AM6).	▮	
	Provide an annual report on the LLNL multiphysics capability development. (AM2).	▮	**Due Q4**
Q3	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, and AM6).	▮	
	Provide an annual report on the LLNL multiphysics capability development. (AM2).	▮	**Due Q4**
Q4	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, and AM6).	▮	
	Provide an annual report on the LLNL multiphysics capability development. (AM2).	▮	**CRIT-2018-006 provided on September 28, 2018**

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: ORNL – AM1, 2, 3, 6, 9, 11, 13, 14 M&O Contractor Name: ORNL Point of Contact Name: Doug Bowen Point of Contact Phone: (865) 576-0315	Reference: DP0909020/ORNL Date of Report: October 19, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**

BUDGET

FY18 Analytical Methods

Legend:
— Approved Budget — Costs
— Planned Spending
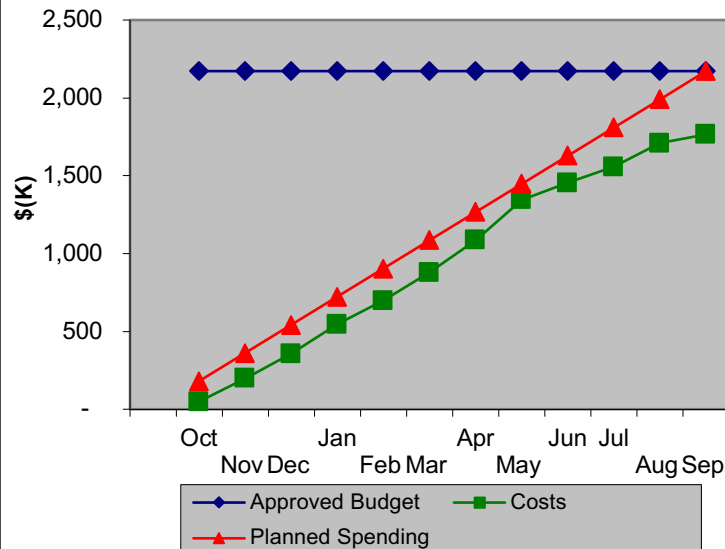
1. **Carryover into FY 2018** = $50K
2. **Approved FY 2018 Budget** = $2172K (includes carryover)
3. **Actual spending for 1ˢᵗ Quarter FY 2018** = $357K
4. **Actual spending for 2ⁿᵈ Quarter FY 2018** = $523K
5. **Actual spending for 3ʳᵈ Quarter FY 2018** = $574K
6. **Actual spending for 4ʳᵈ Quarter FY 2018** = $311K

MAJOR ACCOMPLISHMENTS

AM1 – Distribution of available and newly packaged software
- Distributed 937 software packages and updated 2 software packages.
- 156 SCALE, 472 MCNP®, and 0 COG packages distributed.
- RSICC quarterly report issued.

AM2 - IRSN Area of Collaboration – SCALE/KENO/TSUNAMI
- **Status report on all ORNL participation in US and International analytical methods collaborations and travel.**
  - SCALE Stats:
    - Answered 349 requests for user assistance through scalehelp@ornl.gov.
    - Since 2004, there have been 14,341 distributions of SCALE to 8944 unique users in 59 nations.
   - Since April 2016, the distribution centers have issued licenses for 4,490 copies of the latest SCALE version.
    - Held a week of SCALE training for the Savannah River Site personnel in July. Total attendance - 14.
    - Held a week of SCALE training at the NEA Data Bank in September. Total attendance – 16.
    - Scheduled 4 weeks of SCALE training for October – November 2018 at ORNL.
  - Hosted 2nd Annual SCALE Users' Group Workshop for August 27 – 29, 2018 at the ORNL Conference Center.
    - The workshop provided a highly interactive forum for a fruitful exchange between SCALE users, developers, and sponsors with nearly 100 participants.
    - The agenda included mix of invited and contributed presentations, open discussions, tutorial sessions, technical tours, and live technical support throughout the workshop.
    - See https://scalemeetings.ornl.gov/ for the full agenda and more information.
  - Completed Criticality Safety Validation of SCALE 6.2.2
    - This 188-page document reviews the performance of KENO V.a and KENO-VI
    - Over 600 experiments from ICSBEP in the SCALE Verified, Archived Library of Inputs and Data (VALID) suite.
    - 15 broad categories of systems
    - ENDF/B-VII.0 and ENDF/B-VII.1 multigroup and continuous-energy calculations

- TSUNAMI sensitivity and uncertainty methods applied to assess uncertainties due to cross section covariance data and to examine possible sources of discrepancies for outliers.
  - SCALE/RSICC team recognized by the Federal Laboratory Consortium, Southeast Region
    - 2018 Excellence in Technology Transfer for "Licensing SCALE 6.2: A Software Package for Nuclear Safety Analysis and Design"
  - Continued modernization initiatives for SCALE 6.3 including:
    - Testing ENDF/B-VIII.0 nuclear data
    - Investigating methods for improved used of covariance data, especially in light of the new ENDF/B-VIII.0 disclaimer regarding the suitability of covariance data for use in applications.
    - Integration of Shift Monte Carlo code modernized alternative to KENO V.a, KENO-VI, and Monaco for all SCALE sequences.
    - Updating USLSTATS package to modern software standards and integration with the Fulcrum user interface.
    - Addition of 3D geometry visualization capabilities in Fulcrum.
    - Development of Windows version of AMPX.
    - Migrated software repositories to a new internal infrastructure that enables improve collaborative development across the SCALE, AMPX, and Shift teams.
    - SCALE 6.3Beta1 is planned for the Fall of 2018
  - KENO results for the VALID library using SCALE 6.2.2 were provided to IRSN in March 2018. Little work has been done since then because no further information has been requested from IRSN.

AM3 - IRSN Area of Collaboration – AMPX

- **Status report on all ORNL participation in US and International analytical methods collaborations and travel.**
  - NCSP AMPX funds were expended in July.

AM6 – AWE and IRSN Area of Collaboration – SlideRule (Thomas Miller, Lead)

- An initial set of MAVRIC/Monaco dose calculations for the FY18 work were completed and compared to the MCNP (IRSN) and COG (LLNL) results. A few discrepancies were found between the different code results, but most of these have been attributed to modeling errors. Work is ongoing to address these discrepancies.
- MAVRIC/Monaco FY18 sky shine simulations have not been completed yet.
- A paper discussing our preliminary FY18 results were submitted to RPSD-2018.
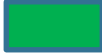
AM9 – IRSN Area of Collaboration – TSUNAMI (Thomas Miller, Lead)

- A set of 4 applications cases was identified by IRSN. USL values were generated for these cases and, after discussion among the NCS applications staff and agreement with the methods used, provided to LANL and IRSN for comparisons

AM11 – U. of Arizona and LLNL Area of Collaboration (TBD, Lead)

- We have not yet heard from LLNL/U. of Arizona to initiate this task. This task has been assigned and contact with LLNL will be made in the near future.

AM13 – U of Florida Area of Collaboration (B.J. Marshall, ORNL Lead; S. Goluoglu, U of Florida Lead)

- Work is ramping up on this task. Two students working on this: Kayla Clements and Andy Rivas, both undergrads. (Kayla interned with Dave Brown's group at BNNL this past summer). AMPX work has begun (installation and testing) to start generating the new cross section libraries. The validation cases will be initiated in late October. The use of undergrads has delayed the initiation of this task but Sedat Goluoglu expects more rapid progress in FY19Q1.

AM14 - U. of Tennessee Area of Collaboration (B.J. Marshall, ORNL Lead; Ivan Maldonado, UTK Lead)

- In the process of finalizing the parameters for the LST experiments with both IFP and CLUTCH. For the IFP parameters, 12 of the 19 cases have been identified and for the CLUTCH parameters, 5 of the 19 cases have been identified. The CLUTCH parameters are becoming increasingly more difficult to identify given the high R2 values in the direct perturbation results. Running additional jobs with differing parameters and perturbations to determine the best solutions. Also running the LCT cases in KENO to begin the sensitivity analysis for these cases as well. Once the KENO jobs for the LCT have been completed, sensitivity analysis will begin as is currently being performed with the LST cases.

- For the second project with the deuterium moderated critical experiments, after meeting with the Nuclear Data group, four cases were selected to perform sensitivity analysis: HEU-COMP-FAST-003-002, LEU-MET-THERM-003-001, HEU-SOL-INTER-001-001, and HEU-SOL-THERM-020-001. These cases provide a variety of neutron energy spectra, material composition, and enrichments. These particular cases were selected based on the agreement between Monte Carlo codes in determining the C/E ratios. Since the original goal was to identify whether deuterium has any effect on intermediate spectrum systems, these cases provide a wide variety of situations for comparison. Sensitivity calculations are being performed with IFP and CLUTCH for CE and MG libraries to get a complete description of the deuterium models. Sensitivity parameters have been found for two of the four cases.
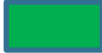
NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
[blue]	[green]	[yellow]	[red]

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q4	Continue distribution of available and newly packaged software to the NCS community requesters (at no direct cost to them) and provide distribution totals quarterly. (AM1)	[green]	AM1 report is provided above under major accomplishments.
	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest. (AM2, AM3)	[green]	AM2/3 report includes information about international analytical methods collaborations. In particular WPEC was attended in Paris, FR. Also, the NCSP execution manager met with AWE/IRSN/JRC-Geel personnel to discuss NCSP collaborations, including SCALE (AM2) and AMPX (AM3).
	Provide a status report on ORNL support on a new SlideRule accident response tool (AM6).	[green]	A report from T. Miller is included in this report for the SlideRule task. There is no defined end to this task at the current time.
	Provide status on ORNL AM activities in NCSP Quarterly Progress Reports. (AM1, AM2, AM3, AM6, AM9)	[green]	A report is provided under the Major Accomplishments section of this report for AM1, AM2, AM3, AM6, and AM9.
	Provide a status report of the progress on the establishment of 1D analytical benchmarks (Univ. of Arizona); provide a progress report of providing COG Monte Carlo Results (LLNL); and Provide a progress report of SCALE Monte Carlo results (ORNL). (AM11)	[red]	There has been no information from LLNL to initiate this task in FY2018. Successful completion of this task is dependent upon LLNL progress. T. Miller is the lead.
	Provide a status report for running verification test cases and comparing to previous results. (AM13)	[yellow]	Work is in progress – work delayed due to the FY2018 CR. More information is available in the Major Accomplishments section.

|			
	Provide a status report for evaluating any additional sensitivity parameters, documenting generation, review and submission to VALID, repeating procedure for additional evaluations as time and budget permits, and submitting paper to winter ANS or NCSP professional conference. (AM14)		Work is in progress – work delayed due to the FY2018 CR. More information is available in the Major Accomplishments section.

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtasks: Information Preservation & Dissemination, ICSBEP (IP&D1), Website and Red Net (IP&D2) M&O Contractor Name: Lawrence Livermore National Laboratory Point of Contact Name: David Heinrichs Point of Contact Phone: (925) 424-5679	Reference: B&R DP0909010 Date of Report: October 20, 2018

BUDGET	MAJOR ACCOMPLISHMENTS
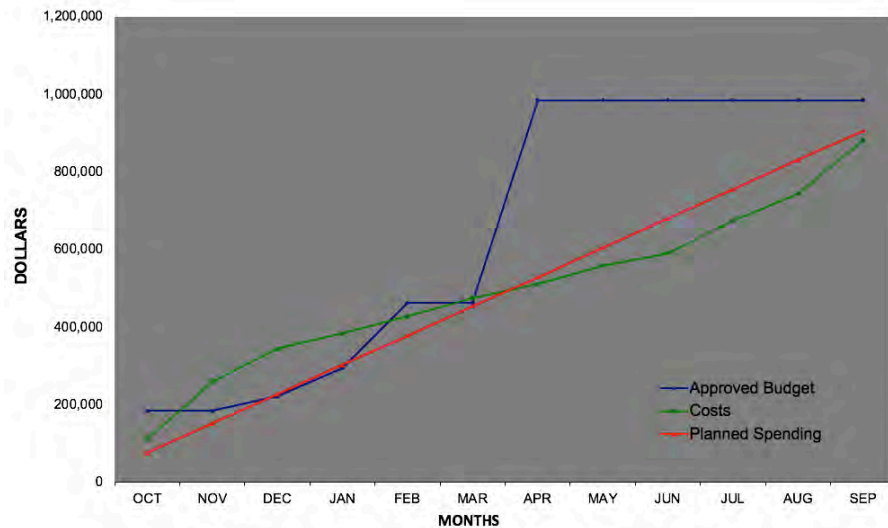
BUDGET

1. Carryover into FY-2018 = $0
2. Approved FY-2018 Budget = $984,000 (Includes carryover from FY-2017)
3. Actual Spending through the end of this quarter in FY-2018) = $881,093
4. Projected carryover into FY-2019 = $102,907 (10%)

MAJOR ACCOMPLISHMENTS

ICSBEP Accomplishments (IP&D1)

- OECD NEA received completed documentation in early October and plans to issue the 2017 edition of the ICSBEP Handbook in late November (2018) and will provide LLNL 200 copies for LLNL to distribute to NCSP members and collaborators.
- LLNL submitted FUND-LLNL-ALPHAN-U235-MULT-001 for **IER-407** [ISSA Subcritical Multiplicity Benchmark] to ICSBEP for independent (external) review by CEA, IRSN, and LANL.
- LLNL reviewed LST012, "TRACY: Unreflected 10%-Enriched Uranyl Nitrate Solution in a 50-cm-diameter Annular Tank," and provided independent COG results to the JAEA evaluator (S. Gunji).
- LLNL (G. Keefer, S. Walston) performed the independent review of FUND-NCERC-PU-HE3-MULT-003 for **IER-422** [SCRaP] (J. Hutchinson)

Website Accomplishments (IP&D2)

- Providing website updates as requested by NCSP Management.
- LLNL completed transfer and performance testing of the IER/CEdT database on the NNSA G2 system at ORNL on August 6-10, 2018. LLNL able to access entire legacy website including IER/CEdT database behind G2 firewalls using an RSA token activated on August 15, 2018. Note that LLNL was unable to the database using our HSPD12 credentials.
- Liaised with the LLNL CIO and briefed the NCSP Manager as to status of Section 508 website assessment tools at LLNL, which should be available for use in scanning https://ncsp.llnl.gov by FY-2019 Q2.
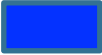
Red Net Accomplishments (IP&D2)
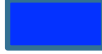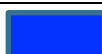
- Performed required updates to NTS-SLAN/NCERC classified network images and servers to ensure the latest Microsoft patches were installed as required and performed required monthly "authenticated" scans for NCERC network devices.
- Received new three-year authorization to operate NTS-SLAN with Sigma 15/20. Installed LLNL iSRD at NNSS (B600) and NSF.
- Provided equipment inspections, certifications and data transfers in support of:
  - IER-435: UNESE Project Irradiations at NCERC (LANL)
  - IER-462: NCSP T&E Hands-On Experiments (LANL)
  - IER-464: NCSP T&E Hands-On Experiments (LLNL)
  - IER-465: Non-NCSP NDSE Experiments in FY16 and FY17 (LANL)
  - IER-492: Non-NCSP Nuclear Smuggling Detector Development May 2018 (LANL)
  - IER-493: Non-NCSP Student Tour July 2018 (LANL)
  - IER-494: Non-NCSP RTO TI Project September 2018 (LANL)
  - IER-495: Non-NCSP ER August 2018 (LANL)

NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
■	■	■	■

| QUARTER	MILESTONE	STA-TUS	ISSUES/PATH FORWARD
Q1	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IP&D1)	■	
	Provide status reports on LLNL participation in US and International IP&D collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (IP&D1)	■	
	Maintain, operate and modernize he NCSP website, databases, and provide user assistance as required. (IP&D2)	■	
Q2	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IP&D1)	■	
	Provide status reports on LLNL participation in US and International IP&D collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (IP&D1)	■	
	Maintain, operate and modernize he NCSP website, databases, and provide user assistance as required. (IP&D2)	■	
Q3	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IP&D1)	■	
	Provide status reports on LLNL participation in US and International IP&D collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (IP&D1)	■	
	Maintain, operate and modernize the NCSP website, databases, and provide user assistance as required. (IP&D2)	■	
Q4	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IP&D1)	■	
	Provide status reports on LLNL participation in US and International IP&D collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (IP&D1)	■	Evaluations in progress for the ICSBEP Meeting in October 2018 are I**ER407** [ISSA], **IER422** [SCRaP], and **IER451** [BUCCX-Ti/Al]
	Maintain, operate and modernize the NCSP website, databases, and provide user assistance as required. (IP&D2)	■	

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: Nuclear Data BNL Task 1 M&O Contractor Name: BNL Point of Contact Name: David Brown Point of Contact Phone: 631-344-2814	Reference: B&R DP 0902090 Date of Report: Oct 19, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**
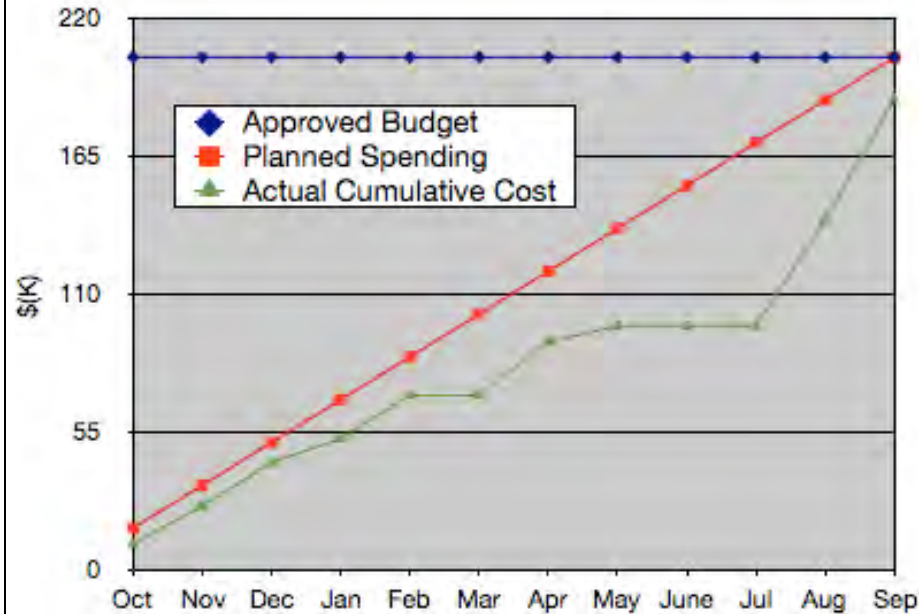
<table>
<tr>
<td>

1. Carryover into FY-2018 = $15,478
2. Approved FY-2018 Budget = $204,912 (Includes carryover from FY-2017)
3. Actual Spending through the end of this quarter in FY-2018 = $188,159

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<td>

- ENDF/B-VIII.0 released 2 Feb 2018 (Happy 50th CSEWG!)
- ENDF/B-VIII.0 release page now up on NNDC website:
  - includes links to GNDS, POINT2018 and ACE formatted files.
  - Includes errata page
- New ADVANCE server delivered and installed

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</table>

NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

| QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		• ENDF/B-VIII.0 to be released on Feb. 2, 2018, approximately the 50th anniversary of the first ENDF release (1st release was June 1968!) • Graphite changes in β6 & β7 necessitate a report/article describing changes and their testing.
Q2	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		• Awaiting server hardware upgrades before beginning to improve ADVANCE • CSEWG recommends improvements to ENDF/B evaluation review process • Waiting for official LANL ACE files for ENDF/B-VIII.0
Q3	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		• New ADVANCE server delivered (to the wrong building!). Will be installed along with other elements of NNDC computing upgrades. • Official LANL ACE files now linked to rest of ENDF release • Upgrade of ADVANCE software is in progress • Posting of ad for post-doc delayed by Office of Science
	If mandated by CSEWG, release new ENDF library. (ND1)		• ENDF/B-VIII.0 released 2 Feb 2018 • Happy 50th CSEWG! • ENDF/B-VIII.0 release page now up on NNDC website
Q4	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		• New ADVANCE server installed, but not yet configured • Developing grokres.py tool (product of BNL-TS6) into full-fledge report for ADVANCE

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: ND1 (Nuclear Data Evaluation and Testing) M&O Contractor Name: LANL Point of Contact Name: Bob Margevicius / Bob Little Point of Contact Phone: 505-665-8965 / 505-665-3487	Reference: B&R DP0902090 Date of Report: October 24, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**
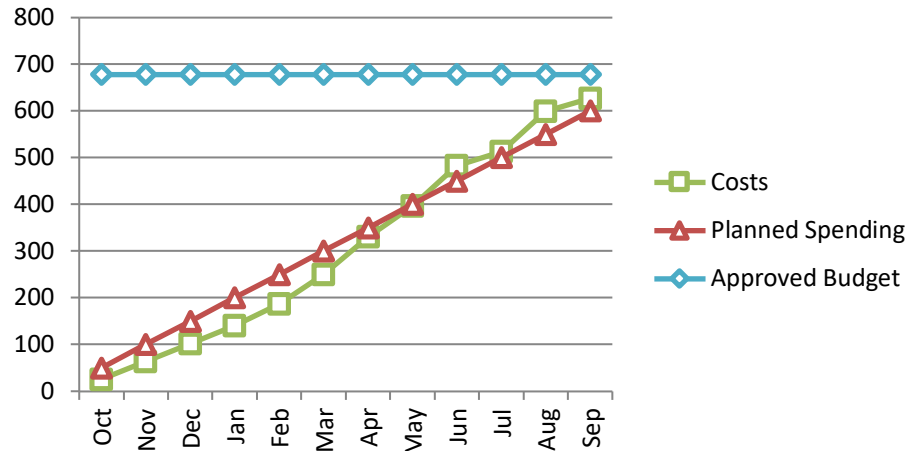
BUDGET

- Carryover into FY-2018 = $0.
- Approved FY-2018 Budget = $678,000 (Includes carryover from FY-2017).
- Actual Spending through the end of this quarter in FY-2018 = $627,206.
- Projected carryover into FY 2019 = $0.

MAJOR ACCOMPLISHMENTS

- We completed a report describing the modest FY18 NCSP investment in a LANL initiative focused on machine learning for nuclear data. Efforts began by bringing nuclear data evaluators and statisticians together to start a discussion and bridge language and jargon barriers typical of every scientific subfield. More detailed discussions followed to uncover intriguing projects that could lead to potential breakthroughs in the future. Limited demonstration studies, in part leveraging other programs, showed great promise. We have also prioritized continuing work in this area for FY19.

- A new fission cross section analysis for U-236 using the generalized least-squares method was performed based on recent experiments by Tovesson et al., as well as data available in the literature. In addition, new Hauser-Feshback model calculations for U-236 agree well with the LSQ results. Other cross sections ((n,2n), (n,3n), capture, inelastic) were also evaluated. The capture results are in good agreement with new DANCE data.

- We published a report summarizing our validation study of ENDF/B-VIII.0 using MCNP simulations of pulsed sphere measurements. Neutron leakage spectra were compared with measurements for over 70 configurations involving ~ 20 materials using both ENDF/B-VII.1 and ENDF/B-VIII.0. (See Neudecker report LA-UR-18-29383).

- We have re-started our analysis of reactions in the n+14N system (15N), including additional charged-particle data. A good fit has been obtained to all the neutron data included at energies up to 2.5 MeV, as well as to charged-particle data for the (p,n) reaction on 14C, and (alpha,n) and (alpha,p) reactions on 11B.

NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
⬛ (blue)	⬛ (green)	⬛ (yellow)	⬛ (red)

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)	⬛ (blue)	
	Conduct CSEWG Data Evaluation Committee session. (ND1)	⬛ (blue)	
	Report data testing results with ENDF/B-VIII.0 cross sections. (ND1)	⬛ (blue)	
Q2	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)	⬛ (blue)	
Q3	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)	⬛ (blue)	
Q4	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)	⬛ (blue)	
	Report planning status of LANL initiative focused on machine learning for nuclear data. (ND1)	⬛ (blue)	
	Deliver nuclear data evaluations as indicated in Appendix B of this document. (ND1)	⬛ (blue)	

NCSP Quarterly Progress Report (FY-2018 Q4)

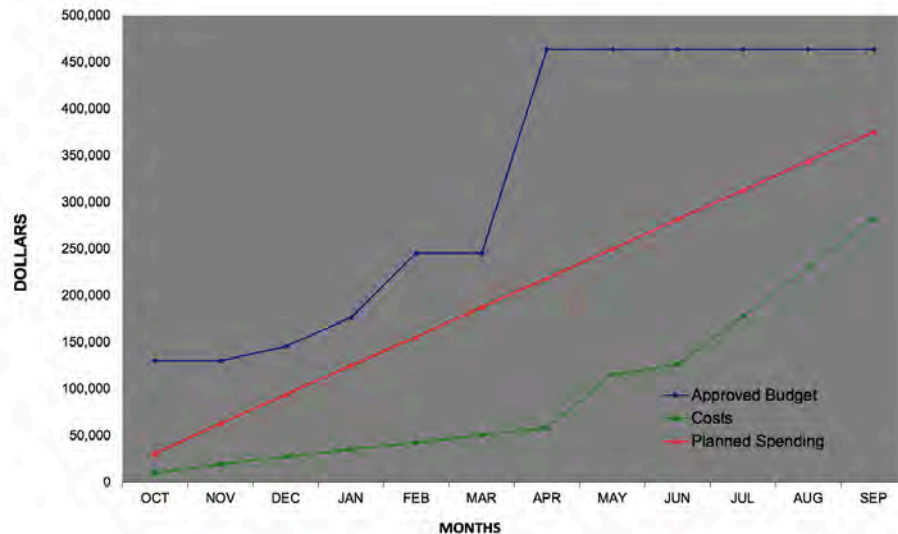|	
NCSP Element and Subtask: Nuclear Data DFGs (ND1), TSLs (ND2), Codes (ND3), Doppler (ND5), Cadmium (ND6) M&O Contractor Name: Lawrence Livermore National Laboratory Point of Contact Name: David Heinrichs Point of Contact Phone: (925) 424-5679	Reference: B&R DP0909010 Date of Report: October 20, 2018

BUDGET	MAJOR ACCOMPLISHMENTS

BUDGET

1. Carryover into FY-2018 = $55,705
2. Approved FY-2018 Budget = $463,705 (Includes carryover from FY-2017)
3. Actual Spending through the end of this quarter (in FY-2018) = $282,345 (does not include $45,459.40 overage on the previous contract; and LLNL has yet to provide $114,000 in FY-2018 funding to NCSU)
4. Projected carryover into FY-2019 = $181,360 (39%) (of which $159,459 is obligated to NCSU leaving only $21,901 (5%) of unobligated carry-over)

MAJOR ACCOMPLISHMENTS

Delayed Fission Gammas (ND1)

- Work continues on documenting LLNL methodology and results for "one-step" COG calculations with delayed fission gammas.

Thermal Scattering Laws (ND2)

- NCSU continued work on molecular dynamics (MD) models for light water. As reported in the past report, the TIP4P/2005f force field was reparametrized and calculations of the thermal scattering cross sections were performed. The ratio of the thermal neutron total scattering cross section at 300 K was calculated relative to that at 473K and compared to experimental (EXFOR) data. The results showed improvement compared to results obtained using the latest ENDF/B-VIII.0 libraries. The calculations were extended and the density of states (DOS), TSL and cross sections were calculated in the temperature range 283 K to 623 K. Variations were observed between the current NCSU results and the ENDF/B-VIII.0 data for DOS, TSL and cross sections. The variations in the total thermal scattering cross sections were found to reach -1% to -10% as the incoming neutron energy decreases for a given temperature. At this stage, the package of TSL libraries and ACE files will be constructed and transmitted to LLNL.

Next Generation Codes (ND3)

- NCSU continued work on the *FLASSH* code. Two developments have been ongoing during this period. The first task is to introduce the ability to treat liquids. This includes the ability to perform "traditional" analysis, where the total TSL for a liquid is calculated based on the convolution of an estimated low energy translational component with a higher energy TSL component that is estimated assuming the applicability of the harmonic approximation and the related phonon expansion. Alternatively, a more realistic representation is also included that would directly perform the Fourier transform of the density correlation functions (derived from classical molecular dynamics simulations) to calculate the total TSL of a liquid material. In this case, the ability to perform the required quantum corrections is introduced to account for thermalization effects such as detailed balance and atomic recoil. The second task is to expand the abilities of *FLASSH* to include cross section calculations and the production of ACE files. This development would allow *FLASSH* to fully incorporate its advanced capabilities in thermal scattering cross section generation. As a first step in this case is to establish the ability to calculate the angular distribution for particle scattering in equal probability bins. The algorithms to perform this analysis are currently under implementation.

NCSP Quarterly Progress Report (FY-2018 Q4)

Advanced Doppler Broadening (ND5)

- NCSU continued the development of the algorithms for relaxing the "cubic approximation" in the calculation of the TSL. In general, the TSL formulation depends on the Debye Waller factor and the related matrix. In the "traditional" cubic approximation, the matrix is reduced to a diagonal form that assumes cubic symmetry. Our previous work on coherent inelastic scattering and generalized elastic scattering has successfully demonstrated the ability to restore the full "non-diagonal" form of the matrix. That work is currently being extended to the complete TSL, where use is made of the availability of the detailed Brilloiun zone information including dispersion relations and polarization vectors as calculated using dynamical matrix analysis. The theoretical approach to perform this analysis has been outlined. Development of the computational algorithms including its integration in the Doppler Broadening operation is currently underway. Testing the algorithms of calculating the Debye-Waller matrix was performed for beryllium using cubic symmetry and the actual hexagonal symmetry. It showed a variation in the diagonal elements of nearly 5% - 10%.

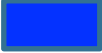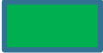Radiative Capture Gamma Production in Cadmium (ND6)

- LLNL Nuclear & Particle Physics Group completed an initial measurement campaign at the UC-Davis McClellan TRIGA reactor including a successful test of a cadmium sample exposed to thermal neutrons showing lots of characteristic (discrete) lines. Background measurements were also performed. Plans for next year include refining and repeating the measurements at lower steady-state reactor power and including some better shielding for the detector.
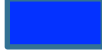
  The photograph (at left) shows the initial (test) set-up with an LLNL detector positioned in Bay 4 aimed at thin sheet of cadmium positioned in from one of the thermal neutron beam lines.

NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
🟦	🟩	🟨	🟥

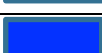| QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status on LLNL ND activities in NCSP Quarterly Progress Reports (ND1, ND2, ND3, ND5, ND6)	🟦	
	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager. (ND2, ND3, ND5)	🟦	
	Provide status on LLNL/IRSN nuclear data activities to NCSP Manager. (ND1)	🟦	
Q2	Provide status on LLNL ND activities in NCSP Quarterly Progress Reports (ND1, ND2, ND3, ND5, ND6)	🟦	
	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager. (ND2, ND3, ND5)	🟦	
	Provide status on LLNL/IRSN nuclear data activities to NCSP Manager. (ND1)	🟦	
Q3	Provide status on LLNL ND activities in NCSP Quarterly Progress Reports (ND1, ND2, ND3, ND5, ND6)	🟦	
	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager. (ND2, ND3, ND5)	🟦	
	Provide status on LLNL/IRSN nuclear data activities to NCSP Manager. (ND1)	🟦	
Q4	Provide status on LLNL ND activities in NCSP Quarterly Progress Reports (ND1, ND2, ND3, ND5, ND6)	🟦	
	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager. (ND2, ND3, ND5)	🟦	
	Provide status on LLNL/IRSN nuclear data activities to NCSP Manager. (ND1)	🟦	
	Deliver thermal neutron scattering data evaluations as indicated in Appendix B of the 5-Year Plan. (ND2)	🟦	

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: ORNL – ND1, 6, 7, 8 **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010/ORNL **Date of Report:** October 19, 2018

BUDGET	MAJOR ACCOMPLISHMENTS

BUDGET

FY18 Nuclear Data

Legend:
- Approved Budget
- Costs
- Planned Spending
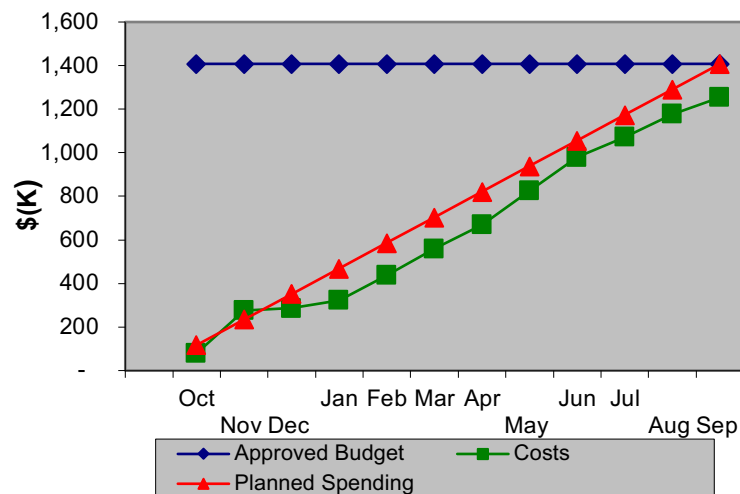
1. **Carryover into FY 2018** = $41K
2. **Approved FY 2018 Budget** = $1,408K (includes carryover)
3. **Actual spending for 1st Quarter FY 2018** = $287K
4. **Actual spending for 2nd Quarter FY 2018** = $273K
5. **Actual spending for 3rd Quarter FY 2018** = $419K
6. **Actual spending for 4rd Quarter FY 2018** = $275

MAJOR ACCOMPLISHMENTS

ND1 – Evaluations and Measurements

- **Status report on all nuclear data support activities.**
  - The evaluations for the seven most important stable dysprosium isotopes, i.e, ^{156,158,160,161,162,163,164}Dy, was completed in the Reich-Moore formalism. The set of ENDF-compatible evaluated resonance parameters was prepared and tested for the submission to the ENDF repository.
  - The completion of an ORNL/TM report is in progress and contains the details of the evaluation work: external function definition, experimental data, evaluation methodology.
  - A first set of resonance parameter evaluation on the $^{n+28,29,30}$Si cross section evaluations was prepared. Although this set of evaluations showed improved agreement with ICSBEP benchmarks compared to ENDF/B-VIII.0, a second set of evaluations on the same isotopes was prepared to improve the energy behavior of the direct capture component. The test on the benchmark for this set of evaluations is currently in progress at the IAEA.
  - Work on writing and updating the letter report for silicon evaluations is in progress. The report will be submitted for review as soon as the test on the benchmark will be available.
  - Work with C. Chapman (ORNL PostDoc) on the set of even-A cerium isotopes, namely ^{140,142}Ce. The work consisted on determining the external functions and analyzing the available experimental data sets also measured on ^{nat}Ce.
  - A repository for the cerium evaluation work and related report was created. Preliminary writing of the ORNL/TM report was performed.
  - ^{156,158,160}Gd - The resolved resonance evaluations of Gadolinium, in collaboration with IRSN (^{155,157}Gd) are progressing in accordance with the NCSP 5-year plan. Fitting of the differential data will be finalized in the Fall of 2019 and a preliminary evaluation is planned to be released to the community for testing. In FY19 the user testing feedback of the evaluations will be collected, and any concerns will be addressed. A joint covariance matrix evaluation will be provided for all five isotopes by the end of FY19 for the work to finish in accordance with the 5-year plan.
  - Pb - The resonance re-evaluation of the lead isotopes has begun. A paper surveying the issues with the current lead evaluations to be addressed in the new evaluations has been submitted to the Winter ANS meeting. Fitting of the differential experimental data will begin in the Fall of 2019.
  - Support to obtain old ORELA high resolution Ta transmission experiments which are

used by Naval Reactors Ta evaluation. Discussion and explanation of the ORELA data with NR personnel. Supplied all experimental information for analysis.

- o Prepared Action sheet 66 for the DOE-Euratom agreement under which the future JRC-ORNL experiments for the NCSP will be performed at the JRC-Geel.
- o Discussion with IAEA personnel about Fe total cross section data and evaluations to support broomstick experiments calculations.
- o Spare ORELA Ta neutron production target was delivered to JRC. Discussion with JRC personnel about operation conditions of the target.
- o Support of post-doc for Ce data analysis.
- o Work on updating Appendix B for the NCSP five-year plan.

- **Status report on all ORNL participation in US and International nuclear data collaborations and foreign travel.**

- **Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5-year plan.**
  - o Data reduction for the thick La sample transmission experiments. Preliminary transmission factors for La obtained.
  - o Prepared input file for SAMMY using ENDF/B-VIII La evaluations.
  - o La data were tested for analysis with SAMMY.
  - o Continued data reduction of the previously obtained neutron capture data for a thick Ce sample. Determination of the flux spectrum, including all corrections. Production of all TOF spectra for Ce sample corrections. Data reduction for the calibration measurement and obtained normalization factor for the thick Ce sample. Obtained preliminary neutron capture cross section for the thick Ce sample, data were tested for analysis with SAMMY.
  - o ^{142}Ce sample was leased for neutron induced cross section experiments in fall at JRC.
  - o Green - Path forward: continue data sorting for La capture data.
  - o Enriched Zr experiments are delayed, due to problems obtaining samples for lease. (Behind schedule). However, this issue seems to be resolved. Path forward: After finalizing the ^{142}Ce experiments, enriched Zr neutron capture experiments will be started.

ND6 – SAMMY Modernization
- **Status report on all SAMMY modernization progress**
  - o Consolidated the list of features slated for the SAMMY release 8.2 tentatively scheduled for Q1 of FY2019
    1. Incorporate a C++ modern Coulomb function library CWFCOMPLEX into SAMMY
    2. Extend summation over channels to include closed channels that were ignored in the legacy SAMMY code

3. Include closed channels in computation of analytical derivatives of cross sections used for optimizing SAMMY R-matrix parameters.

5. Correct the bugs in the I/O of ENDF files for charged particles (whether by making corrections to the legacy code, or by linking to the modern C++ ENDF I/O AMPX library)

7. Employ the SAMAMR module to independently optimize normalization factors of each experimental data set.

8. Enable conversion from formal R-matrix parameters to Brune's alternative R-Matrix parameters

10. Update SAMMY documentation accordingly.

- o Researched various third-party codes as candidates for automated conversion of IMPLICIT Fortran data type declarations to EXPLICIT data types: 1) contacted developers of those codes to obtain evaluation copy of their codes, 2) installed their codes, and 3) researched their documentation to ascertain their suitability for this task. Automating this process with one of these third-party codes would likely save a considerable amount of time and funds.

- o Provided support to SAMMY users, collected SAMMY input files for several particularly complicated bug reports uncovered by evaluators in the legacy SAMMY code, and initiated their debugging process.

- o In order to advertise SAMMY modernization efforts to the broader nuclear data community, we have contributed SAMMY-related sections to an IAEA-sponsored journal article in which results of several available R-matrix codes have been compared.

- o Provided guidance to a NESLS summer intern Jesse Brown of RPI developing improvements to the self-shielding and multiple scattering corrections to the capture yield in the URR.

- o In order to better leverage voluntary contributions to the SAMMY modernization process from SAMMY users worldwide, we have initiated the application process for releasing the SAMMY code under an open source license. This application is expected to be approved pending the release of Coulomb function library CWFCOMPLEX by Dr. Nicolas Michel under an ORNL variant of the open source license.

- **SAMMY modernization progress report (Q4)**
  - o In process of combining al four quarterly reports into a coherent 2018 annual report.

ND7 – Collaboration task with GA Tech (Andrew Holcomb, ORNL Lead)
  - o The contract details and work scope were finalized with Farzad Rahnema, GA Tech, for this task in early Q4. A student was identified (Alex Shaw, MS student) to begin the work. Meetings were held to finalize scope and milestones for the project. Work officially started at the beginning of the new academic year in August.

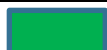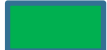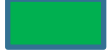|	**ND8 – Nuclear Data Work Plan for U-233 for the NCSP (Due Q3)** • **Status report – This was completed in Q3** **Y12 ND1 Support – GELINA depleted Uranium target cost estimate and construction** • **Status report** ○ Provided operations sequence for the Uranium rotating target construction. Helped to clear up misunderstandings. Provided translations of the drawings details. ORNL support was required to provide Y-12 with the input needed for a certified cost estimate for the DU/Mo target to be fabricated by the end of FY2019. This DU/Mo target will be used to support NCSP ND measurements at GELINA.

NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
🟦	🟩	🟨	🟥

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND6, ND7).	🟩	
	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1).	🟩	
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).	🟩	
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND6, ND7).	🟩	
	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1).	🟩	
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).	🟩	
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND6, ND7).	🟩	
	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1).	🟩	
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).	🟩	
	Complete nuclear data work plan for ^{233}U and provide plan to NCSP Manager (ND8).	🟦	
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND6, ND7).		

	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1).	▢ (green)	
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).	▢ (green)	
	Document SAMMY modernization progress and report status annually to the NCSP Manager (ND6).	▢ (yellow)	In progress – will be done in Q4.

NCSP Quarterly Progress Report (FY-2018 Q4)

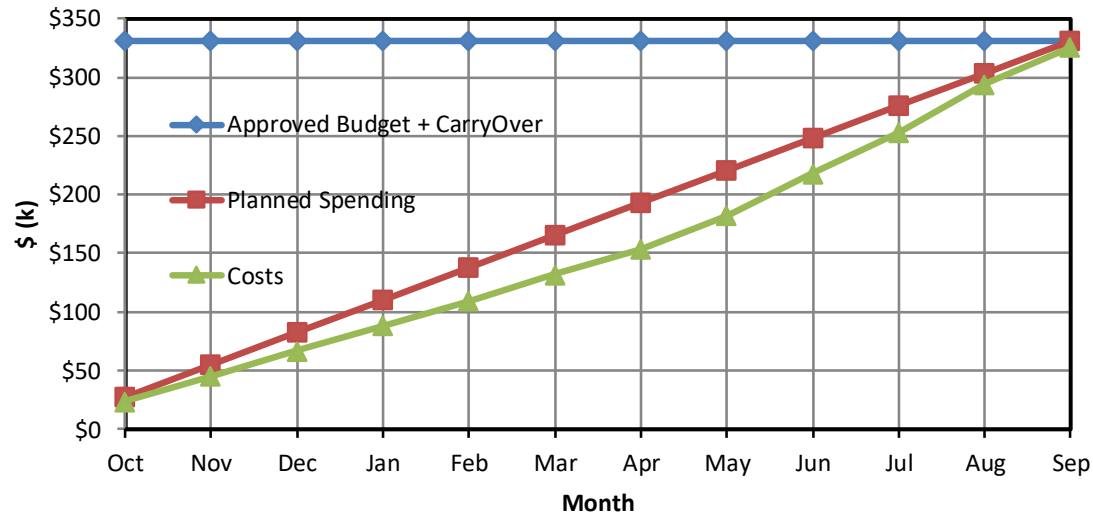|	
NCSP Element and Subtask: RPI-ND1- Resonance Region Nuclear Data Measurement Capability at RPI - Perform cross-section measurements and qualification of the new capabilities **M&O Contractor Name**: RPI **Point of Contact Name**: Yaron Danon *Point of Contact Phone*: 518-276-4008	Reference: RPI ND-1 Date of Report: 10/15/2018
BUDGET	**MAJOR ACCOMPLISHMENTS**

<table>
<tr>
<td>

a) Carryover into FY-18: $-8,520
b) Approved FY-18 budget: $340,000, $331,480 (with carryover),
c) Actual spending through the end of this quarter in FY-18: $325,747
d) Projected carryover into FY-19: $5,733

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<td>

- Completed development of SAMMY modification to process capture yield generated using a weighting function.
- Fitted Ta experimental data using the SAMMY program with the improved capture yield modeling
- Designed a transmission measurement to benchmark resonance self-shielding in a thick Ta sample

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NCSP Quarterly Progress Report (FY-2018 Q4)

RPI ND1 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
🟦	🟩	🟨	🟥

| QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)	🟦	
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)	🟦	
	Complete analysis of measurement from FY17. (ND1)	🟦	
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)	🟦	
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)	🟦	
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)	🟦	
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)	🟦	
	Complete transmission measurement per the nuclear data schedule in Appendix B. (ND1)	🟨	**Scheduling conflicts delayed this experiment to Q1 FY19.**
	Complete capture measurement per the nuclear data schedule in Appendix B. (ND1)	🟦	
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)	🟦	
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on	🟦	

	items of NCSP interest. (ND1)		
	Complete data analysis for transmission and capture measurements and provide the data to ORNL as needed to support the evaluation effort per the nuclear data schedule in Appendix B. (ND1)		**Capture yields and transmission completed, additional experiment delayed to FY19Q1.**

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: RPI-ND2- Thermal neutron scattering measurements **M&O Contractor Name**: RPI **Point of Contact Name**: Yaron Danon *Point of Contact Phone*: 518-276-4008	Reference: RPI ND-2 Date of Report: 10/15/2018
BUDGET	**MAJOR ACCOMPLISHMENTS**
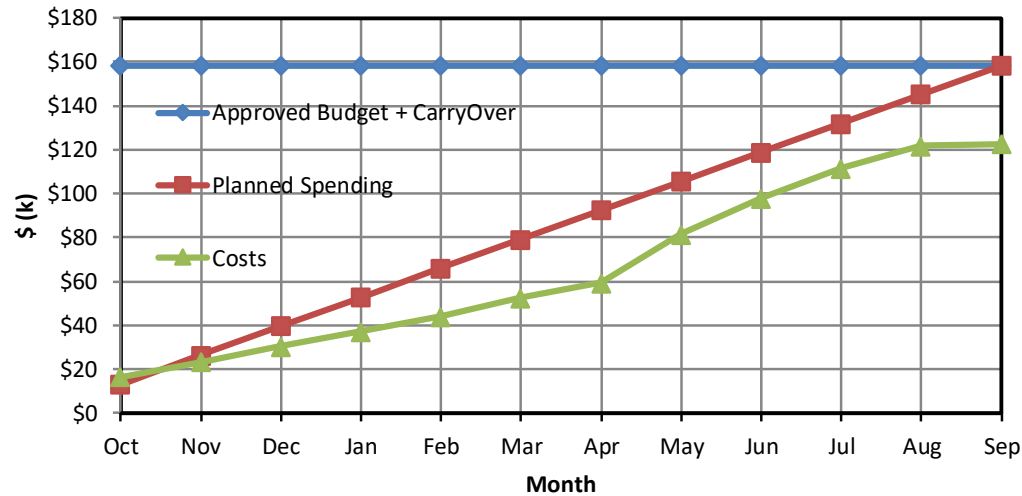
<table>
<tr><td>

1. Carryover into FY-18: $32,481
2. Approved FY-18 budget: $126,000, $158,481 (with carryover)
3. Actual spending through the end of this quarter in FY-18: $122,507
4. Projected carryover into FY-19: $35,974

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- Submitted a paper on lucite to Annals of Nuclear Energy titled: Toward a Better Thermal Scattering Law of $(C5O2H8)\_n$: Inelastic Neutron Scattering and oClimax + NJOY2016.
- ANS Winter submission (from Q3) was accepted for presentation.
- New graduate student joined the project. Will develop new capability for accurate total cross section measurements in the thermal region in support of scattering kernel evaluation.

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NCSP Quarterly Progress Report (FY-2018 Q4)
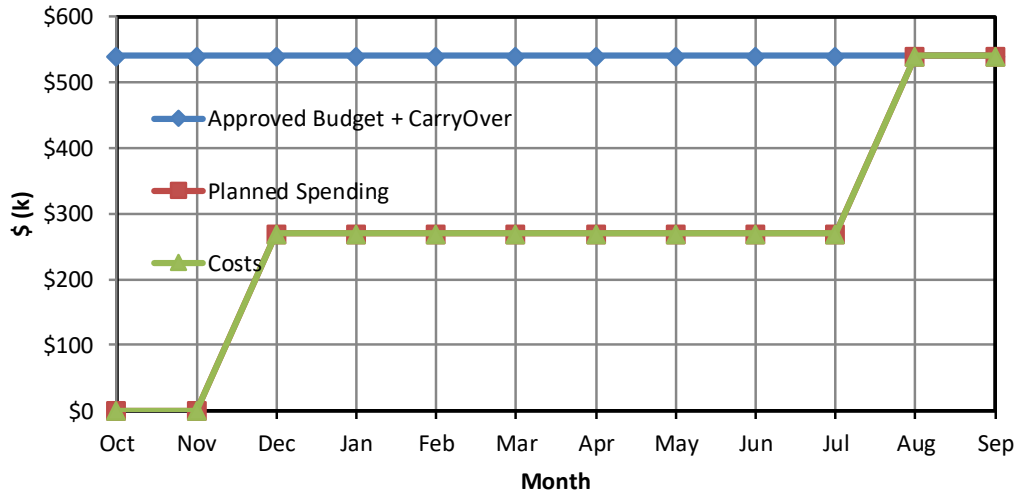
STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
🟦	🟩	🟨	🟥

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)	🟦	
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)	🟦	
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)	🟦	
	Complete thermal scattering measurements per the nuclear data schedule in Appendix B (these are repeat measurment if needed)	🟦	
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)	🟦	
	Complete thermal scattering data analysis and provide the data to ORNL as needed to support the evaluation effort per the nuclear data schedule in Appendix B. (ND2)	🟦	

NCSP Quarterly Progress Report (FY-2018 Q4)
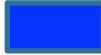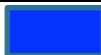
NCSP Element and Subtask: RPI-ND3- LINAC 2020 plan, Nuclear Data Capabilities Maintenance plan **M&O Contractor Name**: RPI **Point of Contact Name**: Yaron Danon *Point of Contact Phone*: 518-276-4008	Reference: RPI ND-3 Date of Report: 10/15/2018
BUDGET	**MAJOR ACCOMPLISHMENTS**

<table>
<tr>
<td>

a) Carryover into FY-18: $0
b) Approved FY-18 budget: $540,000
c) Actual spending through the end of this quarter in FY-18: $540,000
d) Projected carryover into FY-19: $0

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- Factory acceptance test of new modulator is now scheduled to FY19 Q2.

- PO was placed with section vendor expect deliver of first unit for testing in Q2 FY19.

- Phase I of modulator building was completed.

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NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
⬛	🟩	🟨	🟥

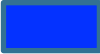| QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)	⬛	
	Place accelerator sections contract with vendor. (ND3)	⬛	
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)	⬛	
	Complete modulator factory test in coordination with NR. (ND3)	🟨	**Factory rescheduled to Q1 FY19**
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)	⬛	
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)	⬛	
	Complete modulator(s) factory test in coordination with NR. (ND3)	🟨	**Factory rescheduled to Q1 FY19**

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: ND Y12- (Prepare Cost Estimate for GELINA Tar-get) M&O Contractor Name: Y-12 Point of Contact Name: Kevin Kimball Point of Contact Phone: 865-576-6675	Reference: B&R DP 0902017 Date of Report: October 16, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**
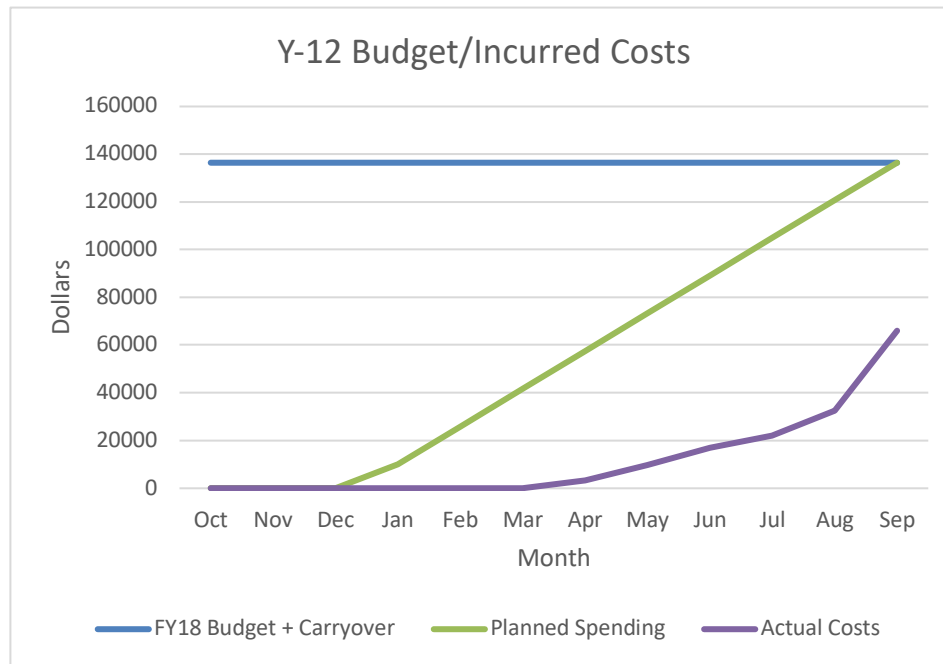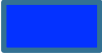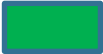
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Y-12 Budget/Incurred Costs

a) Approved FY-2018 Budget = $136,432; CR To Date = $136,432
b) Actual Spending through the end of this quarter in FY-2018 = $66,032

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- Fifteen Gelina drawings scanned into system. Received by Y-12

- Vendor translated drawings into English and converted scans to CAD.

- Cost estimate provided for the fabrication of the GELINA target assembly.

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NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
[blue]	[green]	[yellow]	[red]

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Obtain existing target drawings (Q1)	[blue]	Complete
Q2	Review existing target drawings for completeness and request additional required information (Q2)	[blue]	Complete
Q3	Meet with Y-12 production personnel and external suppliers to obtain estimated fabrication costs (Q3)	[blue]	Drawings were received. Local manufacturer needs a set of CAD drawings in English to complete cost estimate. Vendor selected and approved for converting drawings. Slow procurement process has resulted in delays. Pursuing alternate means of generating estimate as a contingency to ensure we meet Q4 milestone.
Q4	Complete cost estimate for fabrication of GELINA(Q4)	[blue]	Scanned drawings converted to CAD and cost estimate provided. Note that the final cost includes an accrual for the cost of converting the drawings. Final NNSA contractual cost savings add on is not included in costs as that has not been determined yet.

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element: Integral Experiments LANL TE 3 **M&O Contractor Name:** Los Alamos National Laboratory (LANL) **Point of Contact Name:** Robert Margevicius **Point of Contact Phone:** (505) 665-8965	Reference: B&R DP0902090 Date of Report: October 19, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**
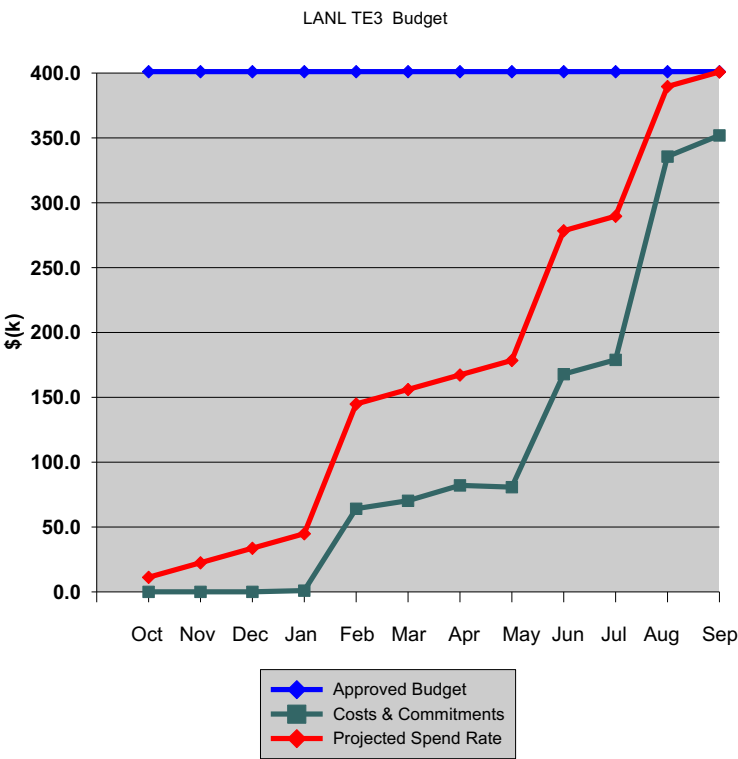
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LANL TE3 Budget

1. Carryover from last FY-17: $38K
2. Total available funding this FY-18: $401K
3. Total spending through the end of the report quarter Q4: $351.9K
4. Carryover into new FY-19: $400K.

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- Participated in regularly scheduled NCSP T&E conference calls.
- Supported execution of hands on portion of two week criticality safety practitioner training class at NCERC.
- Helped the NCSP management team craft responses to the NCSP CSSG comments from the CSSG review of the two week criticality safety practitioner training class.

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NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide class room and hands on training at LANL and at NCERC in accordance with the approved schedule and provide status reports on all training activities in the NCSP Quarterly Progress Reports.		
Q2	Provide class room and hands on training at LANL and at NCERC in accordance with the approved schedule and provide status reports on all training activities in the NCSP Quarterly Progress Reports.		
Q3	Provide class room and hands on training at LANL and at NCERC in accordance with the approved schedule and provide status reports on all training activities in the NCSP Quarterly Progress Reports.		
Q4	Provide class room and hands on training at LANL and at NCERC in accordance with the approved schedule and provide status reports on all training activities in the NCSP Quarterly Progress Reports.		**Underruns from other parts of the program were consolidated in TE3 (as carryover) to cover costs associated with execution of the pilot class for PF-4 operator criticality safety training to occur in November (FY19).**

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: T&E4 (Training in Validation Techniques Using Modern S/U Tools) M&O Contractor Name: LANL Point of Contact Name: Bob Margevicius / Bob Little Point of Contact Phone: 505-665-8965 / 505-665-3487	Reference: B&R DP0902090 Date of Report: October 24, 2018
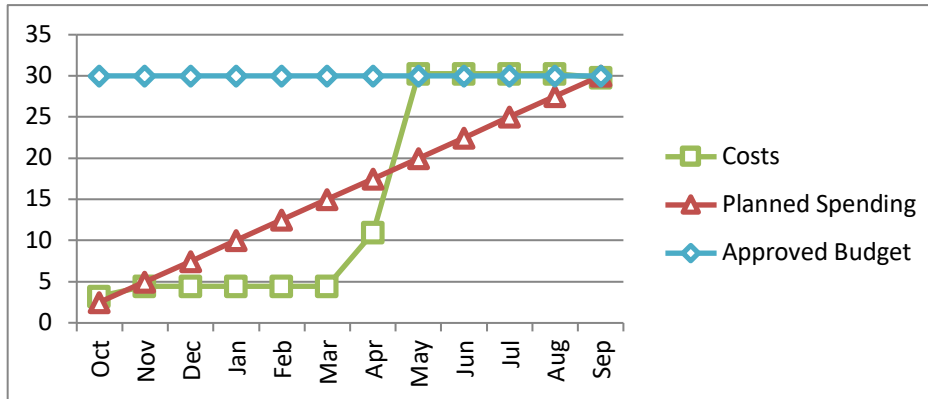
BUDGET	MAJOR ACCOMPLISHMENTS
  1. Carryover into FY-2018 = $0. 2. Approved FY-2018 Budget = $29,000 (Includes carryover from FY-2017). 3. Actual Spending through the end of this quarter in FY-2018 = $29,795. 4. Projected carryover into FY 2019 = $0.	• **Completed Milestone** for FY2018: As reported last quarter, LANL and ORNL jointly provided 1-day validation training class at Savannah River Site, April 23, 2018. Fourteen NCS personnel attended.

NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q4	In collaboration with ORNL, provide introductory 1-day S/U workshop training to one or more DOE sites in FY2018.		

Summary of MCNP Criticality Classes in FY 2018

F.B. Brown, M.E. Rising, J.L. Alwin
Monte Carlo Methods, Codes, & Applications Group (XCP-3), LANL

FY2018 – Q4 classes are highlighted in red.

Classes sponsored by DOE-NNSA-NCSP   (LANL-AM1)

- **Sensitivity-Uncertainty Tools & Practices for NCS Validation**
    - Apr 23, 2018   Savannah River   14 students

  This is a joint effort between LANL & ORNL, covering background material and specific usage of MCNP6-Whisper and SCALE-KENO-TSUNAMI-TSURFER. D. Bowen coordinates scheduling at DOE sites.

- **Criticality Calculations with MCNP6**
    - Feb 26 – Mar 2, 2018   LANL   4 students
    - June 11-14, 2018   Y-12   25 students
    - Aug 6-10, 2018   LANL   12 students

  MCNP criticality class for NCS & reactor physics practitioners, with focus on best practices. Includes 1 day on NCS validation using MCNP6-Whisper.

  For classes at LANL, NCSP-sponsored students do not pay registration fees. For classes at other DOE sites, there are no registration fees.

- **Monte Carlo Techniques for Nuclear Systems**
    - Aug 20 – Dec 10, 2018   UNM   21 students

  This is a 1-semester class for senior undergrads & graduate students at the University of New Mexico. Required for UNM graduation in Nuclear Engineering. Includes Monte Carlo theory & practical use of MCNP6. Several of the students are part of the LANL NCS intern program. (This teaching is partially supported by NCSP, ASC, and other programs.)

- **Advanced Computational Methods for Monte Carlo Calculations**
    - Jan 17–May 9, 2018   UNM & LANL   8 students UNM,   12 students LANL

  This is an advanced class covering details of transport theory, Monte Carlo, advanced computing methods, and code development. Material from this course is also used to teach LANL staff members. (This teaching is partially supported by NCSP, ASC, and other programs.)

Other Classes   (LANL-AM1)

- **Introduction to MCNP6**
    - Dec 4-8, 2017   LANL   15 students
    - Dec 11-15, 2017   NCSU   30 students
    - Jan 8-12, 2018   LANL   15 students
    - Apr 2-6, 2018   LANL   15 students
    - June 4-8, 2018   LANL   14 students
    - June 11-15, 2018   LANL   12 students
    - Aug 13-17, 2018   LANL   15 students

  Standard introductory class, includes 1/2 day on criticality calculations. Classes at LANL are supported by student registration fees.

Summary of NJOY Classes in FY 2018

J.L. Conlin and W. Haeck
Materials and Physical Data Group (XCP-5), LANL

FY2018 – Q4 classes are highlighted in red.

- **NJOY Workshop at RPSD 2018 ("A Brief Introduction to NJOY")**
 - August 26, 2018   RPSD, Santa Fe, NM   12 attendees

  This 4-hour workshop was intended to provide an overview of the status and capabilities of NJOY 2016 and NJOY21.

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtasks: Training & Education, "Hands-on" Training (TE1), Classroom Instruction (TE3), TACS with Be (TE8) M&O Contractor Name: Lawrence Livermore National Laboratory Point of Contact Name: David Heinrichs Point of Contact Phone: (925) 424-5679	Reference: B&R DP0909010 Date of Report: October 20, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**
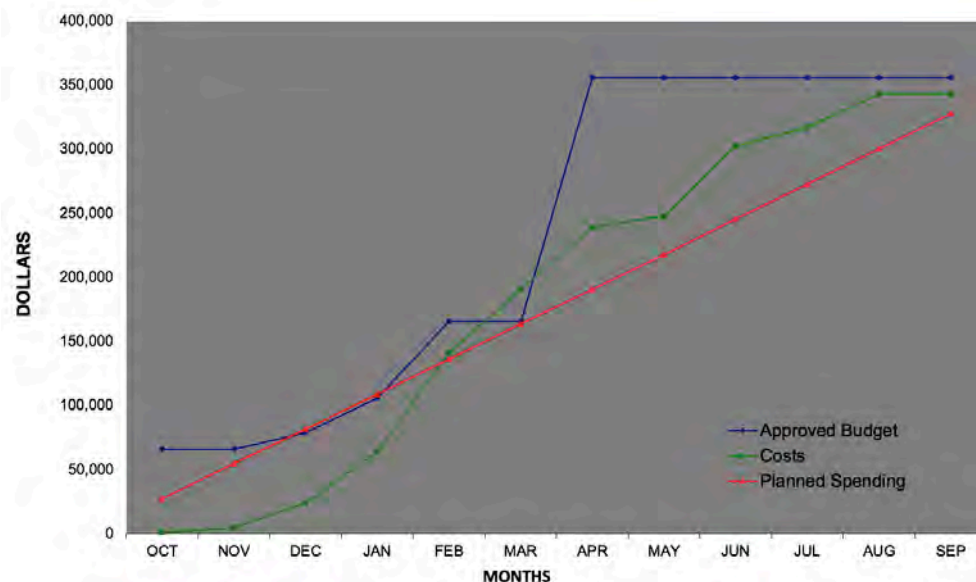
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- Carryover into FY-2018 = $0
- Approved FY-2018 Budget = $356,000 (Includes carryover from FY-2017)
- Actual Spending through the end of this quarter in FY-2018) = $343,459
- Projected carryover into FY-2018 = $12,541 (4%)

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<u>"Hands-on" Training</u> (TE1) and <u>Classroom Instruction</u> (TE3)

- Provided registration and logistics support for:
  - 2-week CSE course on Aug 13-24, 2018 at NATM & NCERC/SNL
  - 2-week CSE course on Jan 28-Feb 8, 2019 at NATM & NCERC/SNL
  - 1 week Managers course on June 3-7, 2019 at NFO/NCERC
  - 2-week CSE course on Aug 12-23, 2019 at NATM & NCERC/SNL

- Provided academic and hands-on instruction for the two-week CSE course at NATM and NCERC on August 13-24, 2018 including the following modules:
  - NCS Fundamentals
  - NCS Evaluation
  - Evaluation Workshops
  - Introduction to Experimental Methods
  - TACS
  - Emergency Response

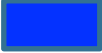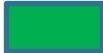- Transferred new ^{241}Am-Be and ^{252}Cf sources to LLNL custody in the DAF.

- Participated in all T&E teleconferences

<u>TACS with Beryllium</u> (TE8)

- Transferred all remaining legacy beryllium shells to LLNL custody at NNSS in three additional shipments.

- Reviewers provided first round of comments on the CSE for adding Be to the TACS.

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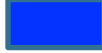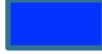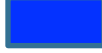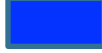
NCSP Quarterly Progress Report (FY-2018 Q4)
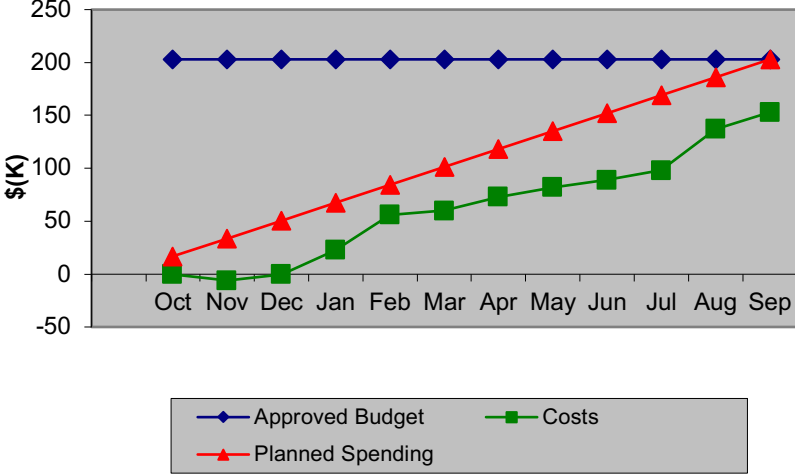
STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
[blue]	[green]	[yellow]	[red]

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager. (TE1)	[blue]	
	Provide LLNL support for FY2018 classroom instruction at the Nevada Site Facility or National Atomic Testing Museum and participation in T&E development activities in accordance with the schedule approved by the NCSP Manager. (TE3)	[blue]	
Q2	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager. (TE1)	[blue]	
	Provide LLNL support for FY2018 classroom instruction at the Nevada Site Facility or National Atomic Testing Museum and participation in T&E development activities in accordance with the schedule approved by the NCSP Manager. (TE3)	[blue]	
Q3	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager. (TE1)	[blue]	
	Provide LLNL support for FY2018 classroom instruction at the Nevada Site Facility or National Atomic Testing Museum and participation in T&E development activities in accordance with the schedule approved by the NCSP Manager. (TE3)	[blue]	
Q4	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager. (TE1)	[blue]	
	Provide LLNL support for FY2018 classroom instruction at the Nevada Site Facility or National Atomic Testing Museum and participation in T&E development activities in accordance with the schedule approved by the NCSP Manager. (TE3)	[blue]	
	Evaluate the TACS with Be shells and provide a status report in the FY2018 Q4 quarterly status report to the NCSP Manager. (TE8)	[blue]	

NCSP Quarterly Progress Report (FY-2018 Q4)
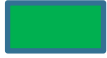
NCSP Element and Subtask: TE1 and TE5 **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010/ORNL **Date of Report:** October 18, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**

BUDGET

FY18 Training and Education

Legend: Approved Budget, Costs, Planned Spending

1. **Carryover into FY 2017** = $0K
2. **Approved FY 2017 Budget** = $203K (includes carryover)
3. **Actual spending for 1st Quarter FY 2018** = $0K
4. **Actual spending for 2nd Quarter FY 2018** = $60K
5. **Actual spending for 3rd Quarter FY 2018** = $29K
6. **Actual spending for 4th Quarter FY2018** = $64K
7. **Projected Carryover into FY 2018** = $53K

MAJOR ACCOMPLISHMENTS

- **TE1**
  - Final report on the CSSG assessment (CSSG tasking 2016-01) to be finalized in FY19Q1.
  - Coordinated and executed the 2-week Hands-on course Aug. 13-24, 2018 at the National Atomic Testing Museum, the National Criticality Experiment Research Center, and Sandia National Laboratory. Bowen and Hicks supported the course as instructors and Scott provided administrative support. The Sandia portion of the course had to be cancelled due to operational issues at Sandia TA-V.
  - Planned a face-to-face meeting with course instructors for the lecture portion of the 2-week hands-on course, currently scheduled for FY19 Q1 (October 17/18).
    - Significant integration of validation, human factors, and NDA lectures are being incorporated into NCS evaluation workshops
    - Training a replacement for Jeff Chapman and backups for training course (Ellen Saylor)
  - Assisted the CSSG draft a tasking for the proposed CSO course to be developed in FY2019.
  - Archived all FY18 data for the NCSP T&E courses on the ORNL SharePoint site.
- **TE5**
  - This task is on hold until new sites are identified to conduct additional courses.

NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
🟦	🟩	🟨	🟥

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)	🟩	
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)	🟩	
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)	🟩	
Q2	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)	🟩	
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)	🟩	
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)	🟩	
Q3	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01.	🟩	

	(TE1)		
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)	🟩	
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)	🟩	
Q4	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)	🟨	
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)	🟩	
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)	🟩	

2018 Q4 – SCALE Training Courses Report for the Nuclear Criticality Safety Program

Class Name	KENO-VI Criticality Safety Calculations Course
Class Dates	July 23 – 27, 2018
Location	University of South Carolina, Aiken, SC for the Savannah River Site
Number of Attendees	14
Short Description	A KENO-VI training course was held at the University of South Carolina-Aiken from July 23-27 for approximately 13 Savannah River Site employees and a member of the DOE Savannah River Site Office. The class provided an overview of the SCALE system and instruction in building and executing criticality safety models including geometry descriptions, material specifications, and Monte Carlo theory.

Class Name	SCALE Criticality Safety and Radiation Shielding Course
Class Dates	Sept 17 – 21, 2018
Location	NEA Data Bank, Paris, France
Number of Attendees	16
Short Description	The class covered criticality safety calculations using KENO-VI and shielding calculations with MAVRIC/Monaco. The capstone problem for this course is the analysis of a mock criticality accident alarm system. The students were pleased with course content and delivery.

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element: Sandia T&E Task 1 – Conduct Criticality Safety Training Classes M&O Contractor Name: Sandia National Laboratories (SNL) Point of Contact Name: Gary A. Harms Point of Contact Phone: (505)845-3244	Reference: B&R DP 0909010 Date of Report: September 30, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**
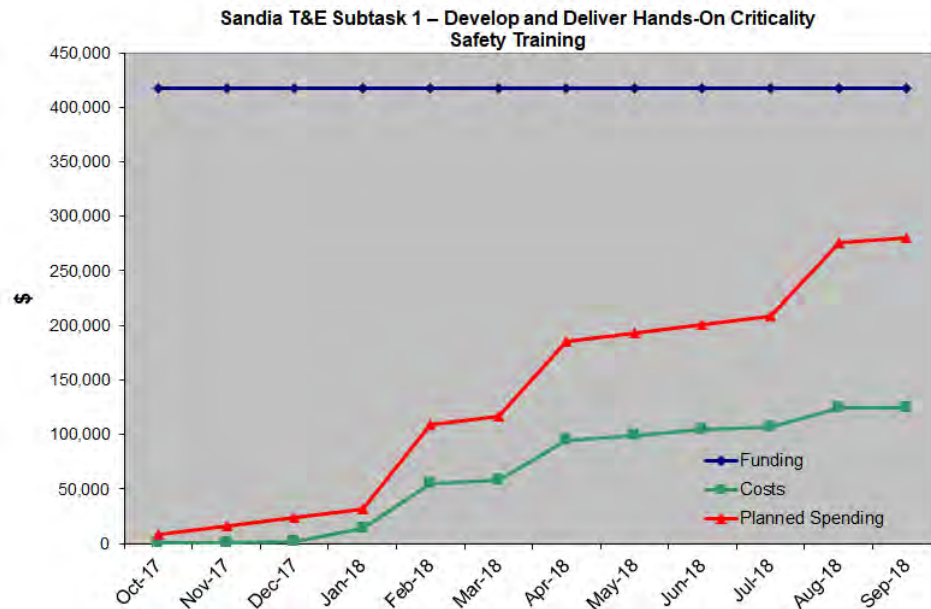
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Sandia T&E Subtask 1 – Develop and Deliver Hands-On Criticality Safety Training

a) Carryover from the Previous FY = $309,801
b) Total Funding Available This FY: $107,968 (new) + $309,801 (carryover) = $417,769
c) Approved Current FY Budget = $280,000
d) Costs at the End of the Quarter = $124,646
e) Carryover into the Next FY = $293,123

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- We supported the delivery in Nevada of a Hands-On criticality safety course for NCSEs in August 2018.
- Preparations for the Sandia portion of the August Hands-On criticality safety class for NCSEs were completed. The class was postponed for reasons outside the control of the personnel working on the class. The students scheduled for attendance at the class were moved into the February 2019 class.

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NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
🟦	🟩	🟨	🟥

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the to the NCSP training courses in accordance with the approved schedule. (TE1)	🟩	
	Provide a status report to the NCSP Manager on the resolution of Sandia course materials and resolutions to CSSG comments provided in the CSSG 2016-01 tasking report. (TE1)	🟩	
Q2	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the to the NCSP training courses in accordance with the approved schedule. (TE1)	🟦	
	Provide a status report to the NCSP Manager on the resolution of Sandia course materials and resolutions to CSSG comments provided in the CSSG 2016-01 tasking report. (TE1)	🟩	
Q3	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the to the NCSP training courses in accordance with the approved schedule. (TE1)	🟦	
	Provide a status report to the NCSP Manager on the resolution of Sandia course materials and resolutions to CSSG comments provided in the CSSG 2016-01 tasking report. (TE1)	🟩	
Q4	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the to the NCSP training courses in accordance with the approved schedule. (TE1)	🟦	**A TSR violation at the Sandia nuclear facilities resulted in the cessation of operations at the facilities. As a result, the Sandia portion of the August Hands-On criticality safety course for**

			NCSEs was postponed. The students will be accommodated in the February 2019 class.
	Provide a status report to the NCSP Manager on the resolution of Sandia course materials and resolutions to CSSG comments provided in the CSSG 2016-01 tasking report. (TE1)		

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: Y12-T&E1 (Conduct Hands-On Criticality Safety Training Course) M&O Contractor Name: Y-12 Point of Contact Name: Kevin Kimball Point of Contact Phone: 865-576-6675	Reference: B&R DP 0902017 Date of Report: October 16, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**
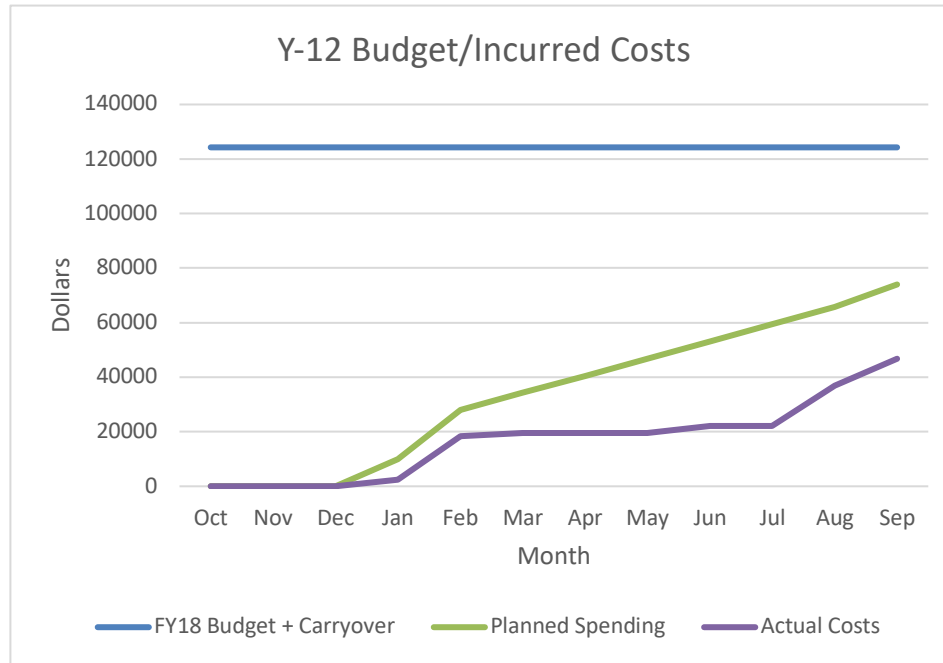
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Y-12 Budget/Incurred Costs

Legend: FY18 Budget + Carryover, Planned Spending, Actual Costs

a) Approved FY-2018 Budget = $124,273; CR To Date = $124,273
b) Actual Spending through the end of this quarter in FY-2018 = $46,773

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- Taught Hand Calculations and the CSE Workshop in January's course and collected feedback on the hand calculation material
- Taught the revised Hand Calculations and the CSE Workshop in August's course

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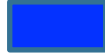
NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Teach hand calculations and the CSE workshop in the course held in Las Vegas January 29th through February 2nd. (TE1)		
Q2	Revise hand calculation material per feedback received in last course. (TE2)		
Q3	Develop new LEU CSE for workshop (TE3)		Initial work has begun on developing the CSE but the CSE was not ready for August class. Revised goal is to have the new CSE ready for the class in January 2019.
Q4	Teach hand calculations and the CSE workshop in August's course. (TE4)		

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: CSSG Support M&O Contractor Name(s): AECOM, ANL, LANL, LLNL, PNNL, SRNS, Y-12 Point of Contact Name: David Hayes (CSSG Deputy Chair) Point of Contact Phone: 505-667-4523	Reference: B&R DP 0902010 Date of Report: October 19, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**

<table>
<tr><td>

CSSG Support Funds FY18

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- CSSG Chair/Deputy duties
- CSSG conference calls
- Prepare/Review taskings/responses (2018-01)
- Budget Execution Meeting

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</table>
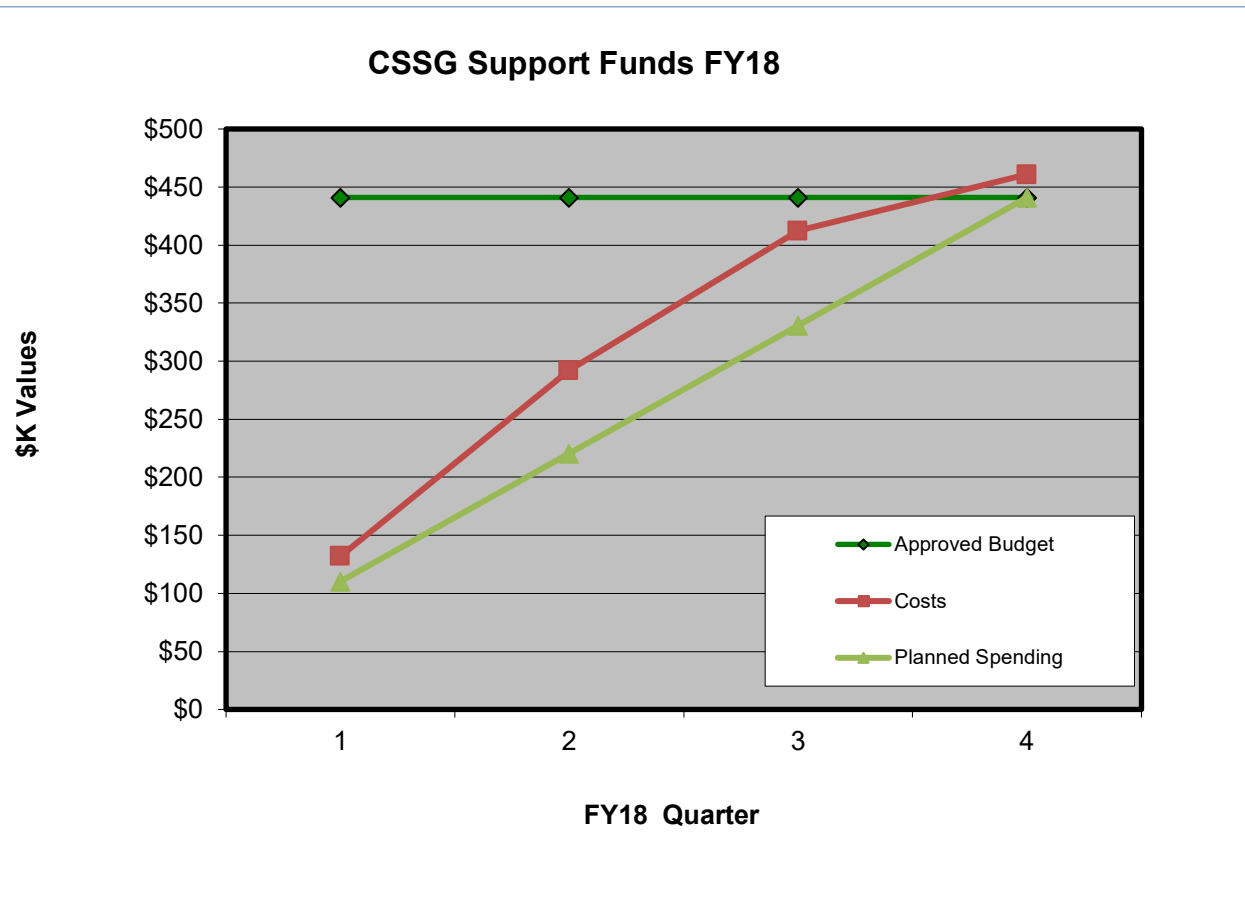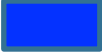
a) Total Budget for FY18 = $441K
b) Actual Total Spending for FY18 = $461K
   Q1 = $132K, Q2 = $160K, Q3 = $120K, Q4 = $49K

NCSP Quarterly Progress Report (FY-2018 Q4)

CSSG TS Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
🟦	🟩	🟨	🟥

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)	🟦	
Q2	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)	🟦	
Q3	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)	🟦	**Issue Tasking 2018-01 and execute** 🟩 **Expenditure, but no billing for EFT in Q3. Burn rate high as mentioned in Q2. Overages to be covered by Site Funding.**
Q4	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)	🟦	**Budget over-runs covered by Site Task Managers.** **Tasking 2018-01 and execute** 🟨 **Funding concerns delayed execution in FY18. Tasking dates need to be revised. Completion expected in FY19Q1.**

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: NCSP Technical Support Task 6 M&O Contractor Name: BNL Point of Contact Name: David Brown Point of Contact Phone: 631-344-2814	Reference: B&R DP 0902090 Date of Report: Oct 19, 2018

BUDGET	ACCOMPLISHMENTS
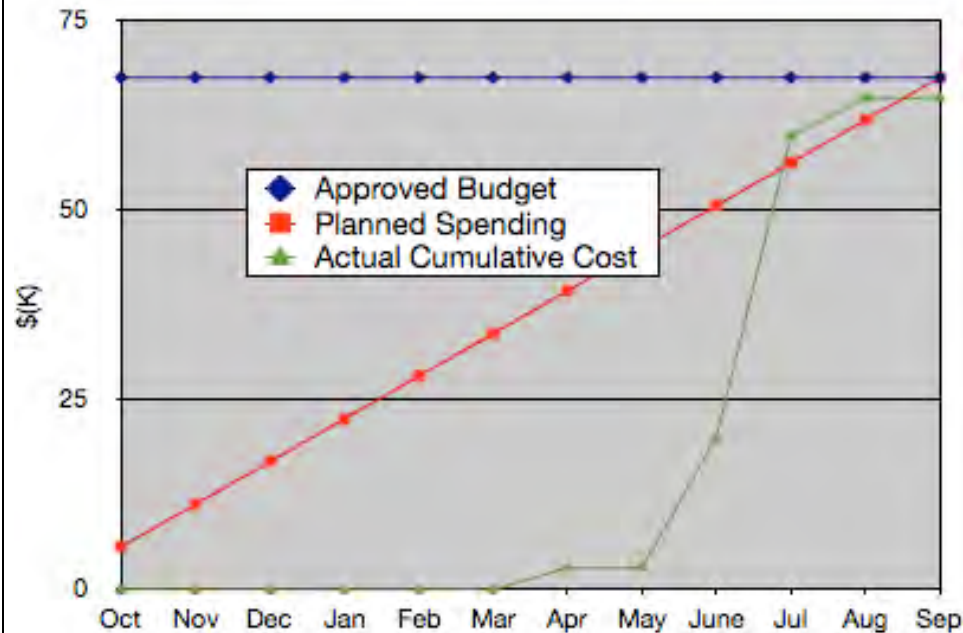
1. Carryover into FY-2018 = $0
2. Approved FY-2018 Budget = $67,566 (Includes carryover from FY-2017)
3. Actual Spending through the end of this quarter in FY-2018 = $64,874
	Work on task has only really started in June, but already several software tools are written and tested:
	• a stochastic resonance generator (mcres.py)
	• a tool for resonance quality assessment (grokres.py), builds off:
	    ○ tools to extract average widths and spacings from RRR (built into inter.py, last year's TS1 product)
	    ○ related Office of Science project gave us a tool to compute average widths self-consistently from Hauser-Feshbach reaction code output (built into FUDGE)
	    ○ collaboration with D. Mulhall (U. Scranton) and summer student (R. Wadgoankar)
	• Lab report detailing mcres.py & grokres.py (BNL-209313-2018-INRE)

MILESTONES	ISSUES/PATH FORWARD
Provide NCSP Manager annual report of succession planning efforts (Q4)	
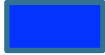
NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q4	Provide NCSP Manager annual report of succession planning efforts.		Completed tool to generate stochastic resonances (mcres.py) and a tool to assess quality of resonances (grokres.py). Both tools to be included in next release of FUDGE processing code. Lab report detailing both tools has been prepared (BNL-209313-2018-INRE). Original goal of "backfilling" 54Fe missing resonances essentially vetoed by CSEWG (or at least every member of CSEWG spoken to about it).

BNL NCSP Succession Planning Efforts in FY 2018

DAVID BROWN
NATIONAL NUCLEAR DATA CENTER,
BROOKHAVEN NATIONAL LABORATORY

OCTOBER 19, 2018

Executive Summary

This document fulfills a technical support element milestone (TS6:Q4) given in the Five-Year Plan. This document describes BNL succession planning efforts in FY-2018 for the Nuclear Data task area.

Technical Support Task 6

Task TS6 was designed to help BNL develop a succession plan for the Atlas of Neutron Resonances [1] and the resonance work of Dr. Said Mughabghab. The Atlas is the most authoritative and complete work on neutron resonances known and the 6th edition was published in Feb. 2018. Sadly, Dr. Mughabghab passed away on July 6, 2018. BNL currently plans that David Brown will assume the lead on future development of the Atlas.

As part of the preparation for this role, D. Brown attempted to "solve the missing resonance problem" in FY18. A report detailing two software packages useful for generating stochastic resonances (mcres.py) and performing resonance quality assessment (grokres.py), including determining the fraction of missing resonances, is available [2]. The original goal of "backfilling" missing resonances in 54Fe was abandoned after significant push-back from the evaluator community. As the ENDF format provides no provision for denoting which resonances are real or artificial, it was felt that the "backfilling" process would only confuse downstream data users.

References

[1] S. Mughabghab, *Atlas of Neutron Resonances, 6th edition,* Elsevier Science (2018)

[2] D. Brown, D. Mulhall, R. Wadgoankar, "A tale of two tools: mcres.py, a stochastic resonance generator, and grokres.py, a resonance quality assurance tool" Brookhaven National Laboratory Report BNL-209313-2018-INRE (2018).

Acknowledgements

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element: Integral Experiments LANL TS 4 **M&O Contractor Name:** Los Alamos National Laboratory (LANL) **Point of Contact Name:** Robert Margevicius **Point of Contact Phone:** (505) 665-8965	Reference: B&R DP0902090 Date of Report: October 19, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**
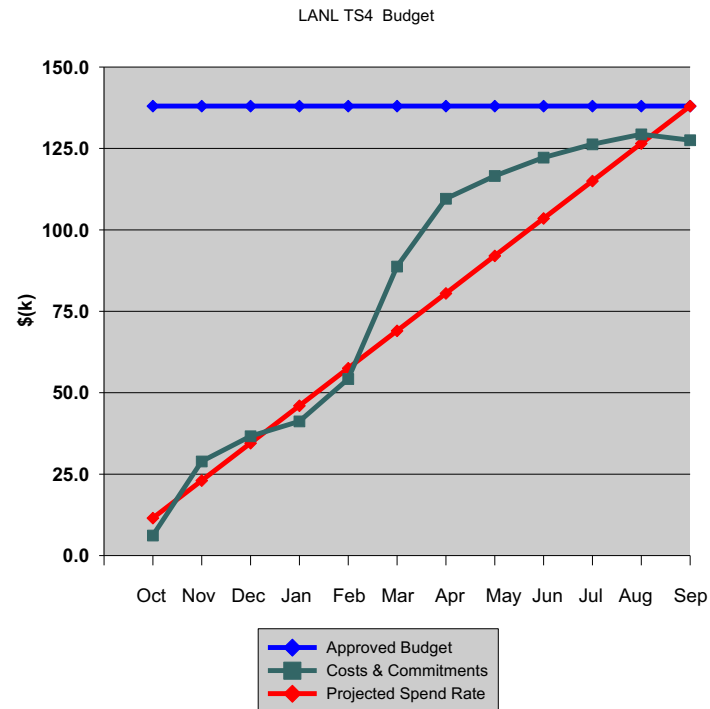
LANL TS4 Budget *(chart: $(k) vs months Oct–Sep; Approved Budget ~138 flat line; Costs & Commitments rising from ~6 to ~128; Projected Spend Rate rising linearly from ~11 to ~138)* Legend: ◆ Approved Budget ■ Costs & Commitments ◆ Projected Spend Rate 1. **Carryover from last FY-17: $0.** 2. **Total available funding this FY-18: $138.0K** 3. **Total spending through the end of the report quarter Q4: $127.5K** 4. **Carryover into new FY-19: $0.**	• Succession planning funding was used to support the summer student appointment of George M. Steinkamp. • George learned how to run the Monte Carlo Neutron Transport Code MCNP© by participating in a one week long MCNP user training class provided by LANL's Monte Carlo Methods, Codes & Applications Group (XCP-3). Upon completion of the training class, George was able to proficiently run MCNP. During his summer appointment, George was able to successfully run some nuclear critical experiment benchmark models that have been published in the NEA/OECD International Handbook of Evaluated Criticality Safety Benchmark Experiments. George ran all the simulations using two different cross section data sets (ENDF/B-VII.2 and ENDF/B-VIII.0) for comparison/validation/verification studies.

NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

| Complete	On Schedule	Behind Schedule	Missed Milestone

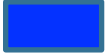| QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q4	Provide NCSP Manager annual report of succession planning efforts.		

To/MS: Robert W. Margevicius, IPM, MS E597
Thru: David K. Hayes, NEN-2, MS B228
From/MS: William L. Myers, NEN-2, MS B228
Phone/Fax: 7-2821/Fax 5-9849
Symbol: NEN-2:18-043

Date: October 23, 2018

Research Note

Advanced Nuclear Technology Group NEN-2
Nuclear Engineering and Nonproliferation Division

SUBJECT: LANL NCSP Annual Report of Succession Planning Efforts (IE Subtask TS4) For Fiscal Year 2018

William L. Myers
Los Alamos National Laboratory
Advanced Nuclear Technology Group (NEN-2)
bmyers@lanl.gov
505-667-2821

This memo fulfills the documentation requirements for the DOE's Nuclear Criticality Safety Program (NCSP) assigned deliverable to Los Alamos National Laboratory's subtask (TS4) associated with succession planning for maintaining the capability and competence of staff for executing the NCSP's mission and programmatic work.

During Fiscal Year 2018, a majority of the provided funding was utilized to enable George (Geordie) E. McKenzie to complete all the requirements to earn his PhD in Nuclear Engineering from the University of Illinois in Urbana-Champaign (UIUC). Geordie successfully defended his Phd thesis on February 26th, 2018. Dr. William (Bill) L. Myers served as his mentor at LANL and served as an external member of his Phd committee at UIUC. Both traveled to Urbana-Champaign for Geordie's thesis defense.
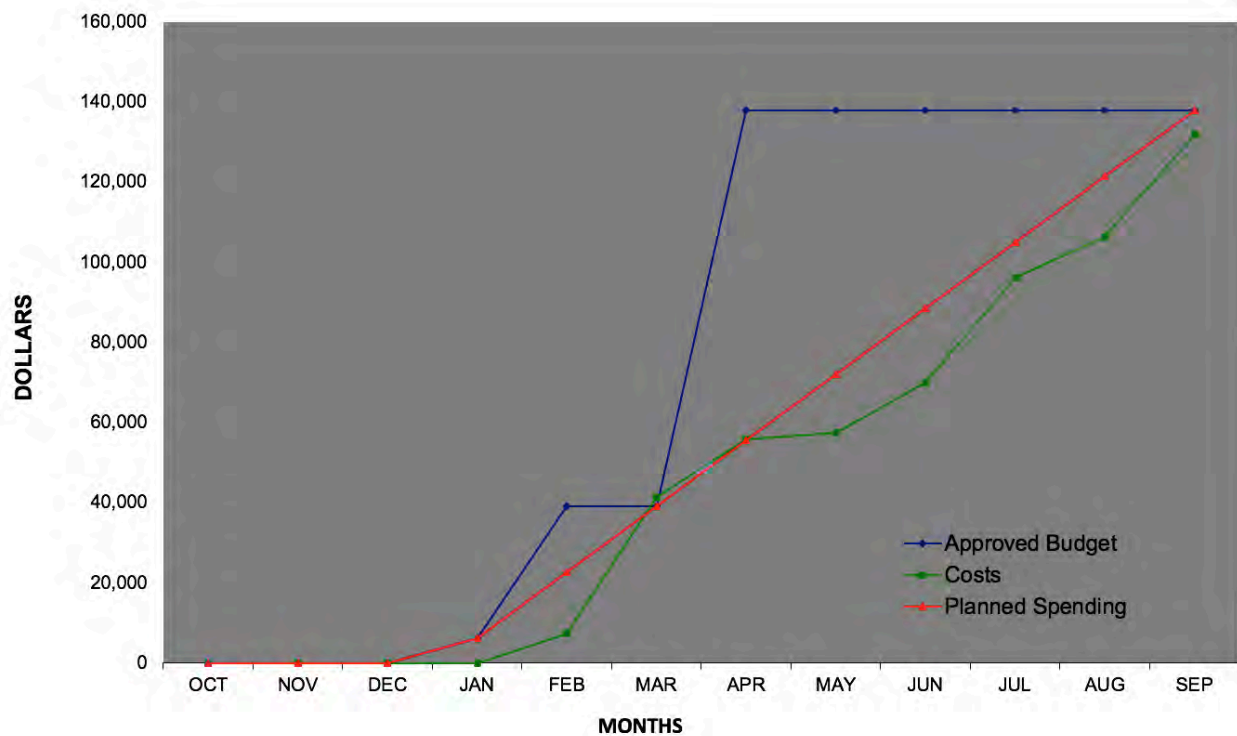
Geordie officially graduated from UIUC in May of 2018. Subsequently, he was hired into the Advanced Nuclear Technology Group (NEN-2) as a Level 2 Research and Development (R&D) Engineer. A summary of Geordie's Phd work was presented at the Physor2018 conference held in Cancun, Mexico.

A smaller fraction of the succession planning funding was used to support the summer student appointment of George M. Steinkamp. George is a University of New Mexico (UNM) student that had just completed his freshman year. George learned how to run the Monte Carlo Neutron Transport Code MCNP© by participating in a one week long MCNP user training class provided by LANL's Monte Carlo Methods, Codes & Applications Group (XCP-3). Upon completion of the training class, George was able to proficiently run MCNP. During his summer appointment, George was able to successfully run some nuclear critical experiment benchmark models that have been published in the NEA/OECD International Handbook of Evaluated Criticality Safety Benchmark Experiments. George ran all the simulations using two different cross section data sets (ENDF/B-VII.2 and ENDF/B-VIII.0) for comparison/validation/verification studies.

WM:wm

Cy: William L. Myers, NEN-2, MS B228
David K. Hayes, NEN-2, MS B228
Robert W. Margevicius, IPM, MS E597
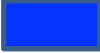
NCSP Quarterly Progress Report (FY-2018 Q4)
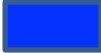
NCSP Element and Subtasks: Technical Support LLNL Succession Planning (TS5) M&O Contractor Name: Lawrence Livermore National Laboratory Point of Contact Name: David Heinrichs Point of Contact Phone: (925) 424-5679	Reference: B&R DP0909010 Date of Report: October 20, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**

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1. Carryover into FY-2018 = $0
2. Approved FY-2018 Budget = $138,000 (Includes carryover from FY-2017)
3. Actual Spending through the end of this quarter (in FY-2018) = $131,914
4. Projected carryover into FY-2019 = $6,086 (4%)

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Analytical Methods

- Shauntay Coleman registered and committed funding for ME 690, "Radiation and Nuclear Criticality Analysis of RAM Packages," at ORNL on September 17-21, 2018; however, the course was cancelled due to insufficient number of attendees.

Integral Experiments

- Liz Heckmaier (PhD, UC-Irvine) accepted a Postdoc appointment effective September 24, 2018.
- Jesse Norris attended the "Introduction to MCNP" training course at LANL on August 13-17, 2018.

Information Preservation and Dissemination

- Chuck Lee at ORNL on August 6-10, 2018 to complete the transfer of the IER/C_EdT database to G2.

Training and Education

- Tony Nelson traveling to NNSS for MC&A and TPR training for DAF.
- Tony Nelson completed the NCERC portion of the 2-week CSE course on August 20-24, 2018 (having previously completed the course at NATM and SNL).
- Doug McAvoy retired effective September 27, 2018. Paul Yap-Chiongco hired as his replacement as LLNL NMO Leader supporting IE and T&E operations effective September 16, 2018.

Annual Report

- Provided LLNL-AR-759758, "LLNL NCSP Succession Planning Efforts in FY-2018," to the NCSP Manager on October 11, 2018.

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NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
▮ (blue)	▮ (green)	▮ (yellow)	▮ (red)

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q4	Provide NCSP Manager annual report of succession planning efforts.	▮ (blue)	

LLNL NCSP Succession Planning Efforts in FY-2018

Dave Heinrichs

September 28, 2018

Auspices

Disclaimer

Executive Summary

This document is the annual report of LLNL succession planning efforts in FY-2018 and fulfills a technical support milestone (TS5:Q4) specified in the Five-Year Plan.

Table of Contents   **Page**

1.0   Management Support

1.1   LLNL Task Manager

LLNL has a formal Continuity of Operations Plan for the position of LLNL Nuclear Criticality Safety Division (NCSD) Leader and LLNL NCSP Task Manager is one of the roles, responsibilities, authority and accountabilities (R2A2) of the NCSD Leader position. The Task Manager R2A2 delegations by major task element are shown in the figure below. Each element (i.e., AM, IE, IP&D, ND, T&E) is described in separate sections.

Operations Manager Paul Yap-Chiongco	Dave Heinrichs NCSP Task Manager	Project Manager Becka Hudson

AM	**IE**
COG Ed Lent, Jerome Verbeke	IER252, 253 Dave Hickman
FUDGE Bret Beck, Caleb Matoon	IER184, 203, 479, 480 Catherine Percher
PREPRO Red Cullen, Arjan Koning	IER-268, 443, 491 John Scorby
Multiphysics Jim Reus, John Scorby	IER292 Jo Ressler
	IER297, 407 Tony Nelson
IP&D	IER325, 448 Greg Keefer, Nigel Kelsall
Websites, Networks Chuck Lee, Stacy Peterson	IER329 Will Zywiec
ICSBEP Dave Heinrichs	IER406 Soon Kim
	IER481 Andrew Wysong
ND	IER484 Alex Romanyukha
Thermal Scattering Ayman Hawari	
Cd (n,g), 233U(n,f) Jason Burke	**T&E**
	Catherine Percher

4

Those individuals highlighted in <mark>yellow</mark> were the main focus of succession planning efforts in FY-2017; namely:

Operations Management

- Paul Yap-Chiongco - replaced Doug McAvoy* as Operations Manager

Analytical Methods

- Jerome Verbeke - replaced Rich Buck* as COG usersrc & userdet developer
- Aryan Koning - replaced Dave Heinrichs as POC (and funder) with Red Cullen
- Jim Reus – assisting and eventually replacing John Scorby

Information Preservation & Dissemination

- Stacy Peterson - replaced Chuck Lee as ncsp.llnl.gov webmaster
- Chuck Lee** - transferred the CEdT database and legacy website to G2 at ORNL

Integral Experiments

- Dave Hickman - replaced Chris Wilson (AWE) as IER-253 lead author
- Jo Ressler - has transferred to Design Physics – replacement needed
- Greg Keefer - is officially the Offsite Nuclear Diagnostic and Detection Operations Lead for N Program (POC for LLNL NCT)
- Nigel Kelsall – replaced Neil McMillan* as the AWE NDA Group Leader and JOWOG 29 Technical POC
- Soon Kim - replaced Luisa Hansen
- Andrew Wysong - replaced Debdas Biswas*
- Alex Romanyukha (Naval Dosimetry Center) - replaced Dave Heinrichs

Nuclear Data

- Jason Burke - replaced Brad Sleaford in the area of gamma production from thermal neutron capture

Additionally, NCSD hired a new Postdoc to work on NCSP projects:

- Liz Heckmaier - UC-Irvine

*Note that these individuals have retired.
**Chuck currently plans to retire in December 2018

1.2   Criticality Safety Support Group (CSSG)

Dave Heinrichs is an LLNL member of the CSSG. Catherine Percher is proposed as a candidate for future membership consideration. She is well known to the group.

1.3   Nuclear Data Advisory Group (NDAG)

LLNL members of the NDAG include Dave Heinrichs and Bret Beck. Ayman Hawari (NCSU) is proposed as a candidate for future membership consideration.

2.0   Analytic Methods

2.1   COG

COG has user-defined source and user-defined detector options to provide advanced users the unique ability to develop their own source code outside of COG for execution inside COG. In FY-2018, Dr. Jerome Verbeke (LLNL) modernized his user-defined source and user-defined detector software for list-mode simulation of detector counts (in time) from subcritical multiplying systems, which was used in the ICSBEP evaluation for IER-407 (ISSA). In FY-2019, Drs. Jerome Verbeke and Ed Lent will determine whether these external features can be generalized as (internal) standard features.

Dr. Jerome Verbeke may also complete implementation of FREYA in COG in support of IER-436, Measurement of Correlated [neutron and gamma] Leakage Radiations from Subcritical Assemblies.   Dr. Verbeke is under consideration as a COG code developer eventually succeeding Dr. Rich Buck, who separated from LLNL on November 1, 2017.

2.2   PREPRO

Dr. Dermott "Red" Cullen developed simplified two-bin probability tables for the Unresolved Resonance Region (URR) from his standard PREPRO multiband parameters. In FY-2017, Dr. Cullen provided URR probability tables in ACE format for uranium and plutonium isotopes for testing by IAEA and LLNL. In FY-2018, Dr. Aryan Koning funded additional research in this area. At LLNL's request, Dr. Koning is considering funding Dr. Cullen to generate a complete ENDF/B-VIII.0 library of probability tables for the URR in ACE format.

2.3   Multiphysics

Multi-physics methods supporting NCSP are built on existing LLNL production software used for multiphysics, hydrodynamic and Monte-Carlo used for a variety of Programs. The developer of these methods, Dr. Jim Reus, has retired but is still available to LLNL via AKIMA. Dr. Reus will supplement and eventually succeed Dr. Scorby as principal user of these methods supporting NCSP multiphysics efforts.

Delayed neutrons are now available in these methods and testing will commence in FY-2019 if funding allows. Additional development is needed for gas generation and two-phase fluid flow for simulation of sub-prompt supercritical excursions and solution accidents, respectively.

3.0 Integral Experiments

3.1 Operations and Maintenance

Paul Yap-Chiongco replaced Doug McAvoy as Operations Manager. Doug McAvoy retired effective September 27, 2018.

3.2 Dosimetry SMEs

Dave Hickman is training Lane Stephens on design, fabrication and utilization of the AWE Passive Neutron Spectrometer (with Gold foils) and the LLNL modified version (with TLDs). Dave is also training Daniel Stone as another NAD SME.

3.3 Criticality Safety SMEs

The graphic below lists current CSEs at LLNL showing 300 years of aggregate experience, which is more than adequate to support DOE NCSP tasks assigned to LLNL.

LLNL Criticality Safety Engineers
(October 2018)

[1] Part-time employee
[2] Limited participation
[3] Contractor
[4] PhD candidate
[5] Postdoc

Name	Role	Degree	Years (since BS)	Years (at LLNL)
Huang[1,2]	CSE (CSAC)	PhD	54	22
Heinrichs	CSE (DL)	MS	38	28
Scorby	CSE	PhD	36	21
Biswas[2,3]	CSE	PhD	52	13
Kim	CSE	PhD	40	11
Percher	CSE	MS	15	11
Krass[2,3]	CSE	BS	27	11
Wysong[2,4]	CSE	MS	11	8
Zywiec[4]	CSE	MS	6	6
Coleman	CSE	BS	4	2
Nelson	CSE-I-T	PhD	8	3
Heckmaier[5]	CSE-I-T	PhD	9	0
Norris	CSE-I-T	MS	1	1
Total			**301**	**137**

4.0   Information Preservation & Dissemination (IP&D)

4.1   Website, Networks and Databases

Stacy Peterson is the TID web designer engaged for the NCSP website modernization effort and is now in charge of continued development and maintenance on institutional servers.

Chuck Lee assisted ORNL in transferring the CEdT database and legacy website to G2 in advance of his planned December 2018 retirement.

Greg White is an LLNL Computer Scientist working with G2 (at LLNL).

4.2   ICSBEP

New evaluations in progress for IER-184, IER-297 and IER-329 will enhance the LLNL cadre of ICSBEP evaluators to include Catherine Percher, Tony Nelson and Will Zywiec in addition to our experienced evaluators Dave Heinrichs, Soon Kim and Debdas Biswas. Note that Debdas Biswas retired from LLNL in May 2017 but is still available through subcontract with AKIMA.

5.0   Nuclear Data (ND)

5.1   Thermal Scattering Laws

LLNL in association with NCSU (and NNL (Bettis)) is developing and testing new thermal scattering laws and developing advanced methods with the work being largely executed by NCSU students. Therefore, succession planning is not required as this project is training the next generation of SMEs in this specialized technical area.

5.2   Radiative Capture Gammas

Jason Burke in the LLN Nuclear & Particle Physics Group replaced Brad Sleaford (ret.) and completed a prototype measurement of gamma production from thermal neutron radiative capture in Cadmium using a thermal beam line at the UC-Davis (McClellan) TRIGA reactor. Note that Brad replaced Firestone from UC-Berkeley.

6.0   Training & Education (T&E)

The DAF NMO List of Qualified Individuals (LOQI) identifies five qualified TACS Instructors (DQNMO05):

- Shauntay Coleman
- Dave Heinrichs
- Catherine Percher (Principal Instructor, LLNL)
- John Scorby
- Will Zywiec

Tony Nelson is in the process of obtaining this qualification now that he has received his Q-clearance and HRP-certification.

Jesse Norris just recently submitted his QNSP initiating the background investigation for a Q-clearance. When obtained, he will commence training for this qualification as well.

Appendix A
Major TS5 Accomplishments Previously Reported in QPRs

Q1

- None (due to Continuing Resolution constraints)

Q2

Analytical Methods

- Jerome Verbeke integrated user-defined source and detector routines into the latest COG11.3 software baseline in support of IER-407 (executing part of the succession plan for Rich Buck, who separated from LLNL effective November 1, 2017).

Integral Experiments

- Tony Nelson presented "ISSA Preliminary Results" at the NCSP Technical Program Review at ORNL.
- Jesse Norris presented "Optimizing TEX-Pu for Testing Thermal Scattering Cross Sections and Maximizing the Intermediate Fission Fraction" at the NCSP Technical Program Review at ORNL winning an "NCSP Best Paper" Award.
- Doug McAvoy transitioning Responsible Individual responsibilities to Paul Yap-Chiongco in support of IE (NAD Lab).

Training and Education

- Shauntay Coleman attended the "hands-on" portion of the two-week CSE course at NCERC on February 5-9, 2018 as part of her qualification as "LLNL NMO TACS Instructor" in support of future NCSP T&E courses.
- Doug McAvoy transitioning NMO Project Lead responsibilities to Paul Yap-Chiongco in support of T&E (TACS).

Q3

Analytical Methods

- Under Phil Kerr's tutelage, Tony Nelson is using the LLNL software 'BigFit' to perform Feynman-Y moments analysis of the measured and simulated count distributions for the **IER-407** [ISSA] ICSBEP evaluation.

Integral Experiments

- Will Zywiec submitted "Computational Optimization of Critical Experiment Designs" to the NCSP Special Session at the ANS Winter Meeting in Orlando, Florida.
- Jesse Norris accepted an offer of employment at LLNL and will join the Nuclear Criticality Safety Division on July 22, 2018.
- Shauntay Coleman attended "Fundamentals of Reactor Kinetics and Theory of Small Space-Time Dependent Fluctuations in Nuclear Reactors" at Chalmers University of Technology on June 18-21, 2018. The foreign travel report is in preparation.
- Catherine Percher presented "Comparison of Experimental and Predicted Temperature Results for TEX" at the PHYSOR 2018 conference in Cancun Mexico on April 22-26, 2018.
- Catherine Percher attended the 30th meeting of the Working Party on International Nuclear Data Evaluation Co-operation (WPEC) at NEA Headquarters on May 14-18, 2019. The foreign travel report is in preparation.
- Doug McAvoy transitioning NMO Project Lead and Responsible Individual responsibilities to Paul Yap-Chiongco in support of IE (NAD Lab, RadChem Lab).

Training and Education

- Tony Nelson and Will Zywiec supported Catherine Percher in teaching the hands-on (TACS) training portion of the 1-week Managers course on June 12, 2018.
- Doug McAvoy transitioning NMO Project Lead and Responsible Individual responsibilities to Paul Yap-Chiongco in support of T&E (TACS).

Q4

Analytical Methods

- Shauntay Coleman registered and committed funding for ME 690, "Radiation and Nuclear Criticality Analysis of RAM Packages," at ORNL on September 17-21, 2018; however, the course was cancelled due to insufficient number of attendees.

Integral Experiments

- Liz Heckmaier (PhD, UC-Irvine) accepted a Postdoc appointment effective September 24, 2018.
- Jesse Norris attended the "Introduction to MCNP" training course at LANL on August 13-17, 2018.

Information Preservation and Dissemination

- Chuck Lee at ORNL on August 6-10, 2018 to complete the transfer of the IER/C_EdT database to G2.

Training and Education

- Tony Nelson traveling to NNSS for MC&A and TPR training for DAF.
- Tony Nelson attended the NCERC portion of the 2-week CSE course on August 20-24, 2018 (having previously completed the course at NATM and SNL).
- Doug McAvoy retired effective September 27, 2018. Paul Yap-Chiongco hired as his replacement as LLNL NMO Leader supporting IE and T&E operations effective September 16, 2018.

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element and Subtask: TS2 (NCSP Technical Support), TS7 (Succession Planning), TS8 (NCSP MGT Tool Prototype), TS11 (CEdT Manage Support) **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010/ORNL **Date of Report:** October 18, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**

BUDGET

FY18 NCSP Technical Support

Legend: Approved Budget — Costs — Planned Spending
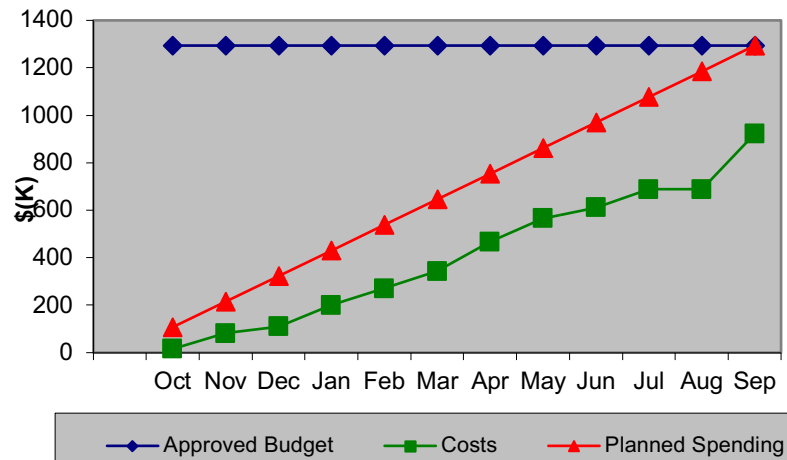
1. **Carryover into FY 2018** = $5K
2. **Approved FY 2017 Budget** = $1,294K (includes carryover)
3. **Actual spending for 1st quarter FY 2018** = $110K
4. **Actual spending for 2nd quarter FY 2018** = $233K
5. **Actual spending for 3rd quarter FY 2018** = $268K
6. **Actual spending for 3rd quarter FY 2018** = $311K
7. **Projected carryover into FY 2018** = $372K

MAJOR ACCOMPLISHMENTS

NCSP TS2 – Program MGT and Execution of the NCSP

- Prepare and maintain elements of NCSP Plan and associated activities:
  - Monitor Five-Year Plan progress,
  - Review/revise task list, and
  - Schedule/participate in meetings and teleconferences.
  - Manage and provide oversight/coordinate efforts for the NCSP Information, Preservation, and Dissemination task element.
  - Manage and provide oversight/coordinate efforts for the NCSP Training and Education Program task element.
- Participated in semi-weekly NCSP management team and other NCSP-related meetings, as required by the NCSP Manager.
- Prepared Q3 QPRs into a single bookmarked PDF file for use in QPR. Conducted Q3 telecon.
- Drafted the summer/fall 2018 NCSP newsletter
- Worked with Mission and Vision team leads to complete their draft Mission and Vision sections. Compiled draft document and prepared for reviews.
- Completed draft main and IE 5-year plans for FY19 to be completed in FY19Q1. Planned and conducted the annual Budget Execution Meeting (BEM) in Las Vegas, NV, in July. The NCSP management team visited the Nevada National Security Site and NCERC after the BEM.
- Participated in CSSG telecons and assisted with CSSG tasks as necessary. Doug Bowen supporting CSSG tasking CSO course baseline tasking report.
- Finalized efforts to improve documentation of NCSP accomplishments to ensure NCSP work is linked to final 5YP milestones. Lori Scott has created new quarterly reporting templates to distribute to the site task managers.

NCSP TS7 – Succession Planning

- Chris Chapman continued to work on nuclear data evaluations with Vlad Sobes as a mentor. Hosted Jesse Brown from RPI to work with the Nuclear Data team on SAMMY modernization tasks for the summer 2018. Andrew Holcomb continued working on tasks to utilize SAMMY and AMPX for NCSP projects.

NCSP TS8 – NCSP MGT Tool

- ORNL continued work on an initial prototype of a new NCSP Program Management Tool. The NCSP IER database from LLNL was moved to ORNL in FY18Q4.

NCSP Quarterly Progress Report (FY-2018 Q4)
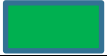
NCSP Element and Subtask: TS2 (NCSP Technical Support), TS7 (Succession Planning), TS8 (NCSP MGT Tool Prototype), TS11 (CEdT Manage Support) **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0909010/ORNL **Date of Report:** October 18, 2018
	This was done to allow the G2 programmers to understand how the database is being used to develop similar functionality in the new G2 system. A tentative, functional, system is slated to be completed at the end of FY19Q1. Numerous telecons were supported in Q4 to ensure the G2 subcontractors understood the purpose of the system. **NCSP TS11 – C$_E$DT Manager Support** • ORNL conducted monthly integral experiment telecons and planned a face-to-face meeting at Sandia in October. The C$_E$DT manager tracked IER products and Baseline Change Reviews and worked with the NCSP manager to approve tasks, as required. • Thomas Miller, C$_E$DT Manager, resigns from ORNL in FY18Q4. Transition of C$_E$DT duties back to Doug Bowen was initiated. • All BCRs for FY18 have been processed by C$_E$DT Manager and a final IER status report was sent to the NCSP manager in September. Worked with the NCSP manager on IER report approvals. • Bowen and Miller continued efforts to work with Tim Wynn (ORNL) and Ty Deschamp (NA-50) about tracking IERs in the G2 system. A rudimentary system should be developed by the end of CY2018. Working with LLNL to decommission the LLNL IER database. • Supported the development of the annual integral experiment 5-year plan.

NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
🟦	🟩	🟨	🟥

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)	🟩	
	Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. (TS2)	🟩	
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)	🟩	
Q2	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)	🟩	
	Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. (TS2)	🟩	
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)	🟩	
Q3	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)	🟩	
	Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. (TS2)	🟩	
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)	🟩	
Q4	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)	🟩	

NCSP Quarterly Progress Report (FY-2018 Q4)

|			
	Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. (TS2)	🟩	
	Participate in Q4 Budget Execution Meeting and assist NCSP Manager in finalization of approved tasks for next FY. (TS2)	🟩	
	Publish final Five-Year Plan. (TS2)	🟨	The 5YP has been delayed due to budget reduction in the NCSP and budget questions at the various sites. Further, plan reviews by some sites have resulted in significant delays to finalizing the plan. The main 5-year plan was finally published in October 2018. The IE 5-year plan is to be completed at the end of October.
	Provide NCSP Manager a status report of progress on the development of a program management tool. (TS8)	🟩	Miller is leading this effort as C$_E$DT Manager. A rudimentary system is expected sometime near the end of CY2018. The IER database will be decommissioned in FY2018 Q4 once the G2 upgrades are sufficiently mature.
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)	🟩	Thomas Miller has resigned and CEDT manager duties are being transitioned to Doug Bowen until a replacement can be identified.

NCSP Quarterly Progress Report (FY-2018 Q4)

NCSP Element: Sandia TS3 – Secure the Future of the SCX M&O Contractor Name: Sandia National Laboratories (SNL) Point of Contact Name: Gary A. Harms Point of Contact Phone: (505)845-3244	Reference: B&R DP 0909010 Date of Report: September 30, 2018
BUDGET	**MAJOR ACCOMPLISHMENTS**
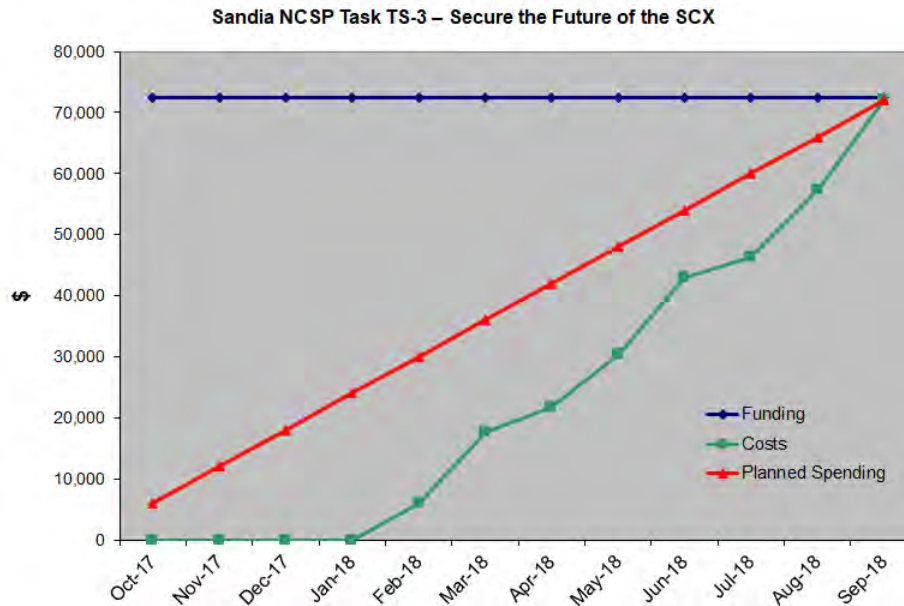
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1. Carryover from the Previous FY = $1,695
2. Total Funding Available This FY: $70,670 (new) + $1,695 (carryover) = $72,365
3. Approved Current FY Budget = $72,000
4. Costs at the End of the Quarter = $72,012
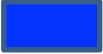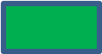5. Carryover into the Next FY = $353

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- We have a matrixed employee who is being trained as an experimenter.

- The new experimenter is documenting the IER-451 experiments. A draft of the evaluation was submitted for review at the October 2018 annual meeting.

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NCSP Quarterly Progress Report (FY-2018 Q4)

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
(blue)	(green)	(yellow)	(red)

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q4	Provide NCSP Manager annual report of succession planning efforts.	(blue)	